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Mr. Hoover's Attitude Toward the Merchant Marine

THE views of Herbert Hoover, the Republican nominee for President, as to the methods best calculated to promote the development of an American merchant marine were clearly expressed in an address delivered at Boston on October 15. After a general discussion of the importance and value of foreign trade to a nation such as ours, with a large surplus of productive capacity, both agricultural and manufacturing, Mr. Hoover said that with the legislation passed by the last Congress, through which a number of indirect aids are given to the merchant marine, "there is real hope that the Government will ultimately be able to retire from competition with its own citizens in the shipping business." But, he added, it cannot retire until we are sure that private enterprise can carry the burden and grow in strength.

"It is a certainty," he declared, "that government operation will always be unsatisfactory. The Government can not operate cheaply; it can not rid itself of pernicious bureaucracy and politics; it can not avoid the interminable difficulties and wastes which come from this kind of organization and direct or indirect political pressures. The hope of a substantial merchant marine lies ultimately in the new character of overseas shipping, in the energy and initiative of our citizens with assistance and co-operation of the Government. That assistance and co-operation is now being given and must be continued."

"A merchant marine under the American flag," he said, "is an essential to our foreign trade. It is essential to our defense. There is only one protection of our commerce from discrimination and combination in rates which would impose onerous charges upon us in the transportation of our goods to foreign markets—that is, a merchant marine under the control of our citizens. We have had need to revise our vision upon overseas transportation during the past few years. It no longer comprises large numbers of tramp steamers going hither and yon. From the point of view of our commerce it consists of about 25 important sea routes which are the extensions to foreign destinations of our inland trade routes, upon which we need regular, ferry-like service of large cargo liner ships. This development of large units and repetitive operation fits with the character of our industrial development and opens wider hope for our return to the sea.

"We have endeavored for two generations to find methods for restoration of that prestige on the ocean which New England at one time gave us. During late years we have tried government ownership and operation. No one can now claim that government operation gives promise of either efficiency or permanence. But by government operation we have maintained our independence and our defense in the meantime. By it we have been able to pioneer the trade routes and to build up a substantial flow of goods. Thus far it has been successful, but at heavy cost. As these routes have gained in strength many of them have already been disposed of to successful operation by private enterprise."

Mr. Hoover is a staunch supporter of the merchant marine. No one in public life knows better than he the vital importance of adequate shipping facilities for the development of our foreign trade. In his speech at Elizabethton, Tenn., on October 6 he said, "Because three million of our homes obtain their support from the manufacture of articles which we import and export, we must continue to promote and defend our foreign trade. We must assure a sound merchant marine to safeguard our overseas trade from foreign discrimination." A sound merchant marine means to him one that is owned and operated by private citizens with proper assistance and co-operation from the Government so that it can meet foreign competition and expand

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with the steadily increasing demands of the nation's commerce. This is what the marine industries have been demanding for years and under Mr. Hoover's constructive leadership there is excellent promise that constructive leadership there is excellent promise of its ultimate attainment.

A Standard Port Safety Code

AN OUTSTANDING development at the annual meeting of the Marine Section of the National Safety Council, held last month in New York, was the decision to establish a standard port safety code for all United States ports to govern the handling of the 125,000,000 tons of cargo passing through these ports each year. This decision was reached as the result of a conference of government officials, port authorities and representatives of shipowners, longshoremen and stevedores called by the American Engineering Standards Committee at the request of the National Safety Council.

At the conference it was pointed out that, unless an effective effort is made to eliminate the thousands of serious accidents occurring annually in the handling of cargo, the United States Employees Compensation Commission, which is authorized by Congress to recommend safety regulations for longshoremen, will establish such a safety code which would become a law and which might be drastic and burdensome. If, on the other hand, a standard national code is established through the co-operation of employers, employees and governmental interests, it is believed that the desired results will be obtained without the necessity of legislative action. As a result of the conference, the American Steamship Owners' Association was authorized to proceed with the preparation of a port safety code, which will cover the loading and unloading of vessels and the moving and handling of goods on wharves, piers, lighters and ships.

The problem of establishing a safety code that will be acceptable in all ports and satisfactory to all steamship owners is by no means a simple one, as the conditions vary widely in different ports and the types of cargoes handled by different companies also differ widely. For instance, the safety code already established in Seattle, which has been very effective in the prevention of accidents, differs materially from a similar code being compiled for the same purpose in San Francisco. On the Great Lakes some very effective rules have been established by ship safety committees but these are applicable only to workers on the ships and do not apply to the handling of cargoes between the ship and shore, which, in this case, is done mostly by machinery. Excellent progress has also been made with safety campaigns by individual shipowners on the Atlantic seaboard. These, however, differ widely in accordance with the type of cargo handled.

The task before the American Steamship Owners' Association, therefore, is one that involves a thorough investigation of all that has so far been accomplished in this direction by the various ports and individual companies, with a view to compiling a set of rules or code that will cover the ground common to all, leaving the special fields or requirements to be covered later. The rules must be simple and generally applicable and they must have the approval of the various interests concerned. In short, it must be a workable code, and it must be developed with the full co-operation of all interests concerned.

Conversion of Government Merchant Ships

ALTHOUGH the cost of the Diesel conversions which the Shipping Board has carried out has, from the point of view of the private shipowner, been excessive, it cannot be denied that this work has, in certain ways, been, or will eventually prove to be, of very real value to the country.

Notwithstanding the fact that the conversion program has been so handled that it has been of little real aid to the long-suffering shipyards, for whose benefit it was in large part originally intended, and that, furthermore, it has thus far produced motorships of very doubtful value when compared with new foreign-built vessels of the same class, it has placed this country in a position where it can gain from its own ships first-hand information regarding the building, operation and economy of performance of marine Diesel engines.

While this pioneer conversion work has been tremendously expensive and has produced vessels which, as the law now stands, the average ship operators cannot afford to buy—nevertheless they are real motorships and, in themselves, very good motorships. Their excessive cost has been due in part to the pioneer character of the work and in part to the apparently unavoidable high cost of *all* government work of similar character.

Although the private shipowner may not be financially able to avail himself directly of the superior economies which these particular vessels are reported to offer, he is in a position to benefit by the experience gained with them not only because of the resulting addition to the fund of available knowledge of motorship operation in this country, but, what is even more to the point, because of the development of the Diesel-building industry which the conversions have made possible and the fact that they have been the means of familiarizing the shipyards with the many peculiar features which characterize the motorship and her machinery.

It has been suggested that the Government should now undertake wholesale conversion to motor drive of its remaining idle vessels in order to reduce the cost of Diesel engines, but, aside from the fact that we now have enough, and more than enough, slow-speed cargo ships, it would appear of far greater advantage to this

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country's shipping interests, if the future ventures of the Shipping Board into the productive field should be of qualitative rather than quantitative character. In the development of new or modified types of propelling machinery there is much, in this country at least, which should be done, and, in view of the present condition of our shipping industry, it would appear that the Government is about the only agency which is financially able to do it in an effective manner.

With the completion of the large cargo vessels now being fitted with Diesel-electric propelling machinery, the Shipping Board will have in operation a fleet of vessels which will cover, fairly well, the whole range of motorship types. While by no means all of the leading makes of Diesel engines will be found on these ships, the various basic types will all be represented, as two-cycle and four-cycle engines are included in the conversion program, and, moreover, each type is represented by both single-acting and double-acting engines. Finally, the range of type will be completed by the Diesel-electric ships now being converted.

It would seem that the motorship field has been fairly well covered and that the Shipping Board will soon be in position to obtain rather complete and conclusive data as to the relative merits of the various vessels.

Having this fact in view, a further conversion of government vessels to Diesel drive appears to be an unwarranted expenditure. A greater service to shipping can be rendered by a similar effort in the field of improved steam propulsion. A start in this direction has already been made with the fitting of the steamship *Mercer* with apparatus for burning powdered fuel. The equipment of the *Mercer* is necessarily of an experimental character, and consequently expensive, but it has opened up for the private shipowner a road to new economies in ship operation of the greatest importance and value.

Pulverized-fuel plants are an outstanding step in advancing the development of steam generation but of equal importance in this particular field is the mechanical stoker. Both are at present in the experimental stage, so far as marine plants are concerned, but that they will eventually be the means of greatly strengthening the position of the marine steam plant and insuring its future, there can be little doubt. In the economical use of steam, once it is generated, developments of equal importance are underway and may well be accorded a share in the Shipping Board's conversion activities. Certain of the present reciprocating engine vessels should be fitted with Bauer-Wach exhaust turbines, and, what would be an entirely justified expense, the equipment of at least one vessel with high-pressure boilers and poppet valve engines.

Recent developments in high-pressure turbines are too well known to call for comment—some vessels should be equipped with high-pressure steam plants without delay, if the Shipping Board is really to complete, in a broad sense, the development work in economical ship propulsion to which it committed itself when it initiated the "Dieselization" program.

That the Diesel is the superior of the most economical steam plants in so far as fuel consumption alone is concerned, no one can well deny, but fuel consumptions is by no means the only factor in the problem of successful ship operation. For American-built vessels on the shorter trading routes, with present fuel prices and *present Diesel first costs,* the steamer is at least on an equality with the motorship; with the additional economies which may be expected from the developments which have been outlined, the steamer may have a distinct advantage and this fact should qualify the future conversion projects contemplated by the Shipping Board.

It seems fair to assume that increased volume of production will decrease the cost of Diesel engines in this country. For the smaller sizes of engines this reduction is already in evidence, but to make use of these smaller and cheaper engines in the propulsion of large vessels some type of intermediate gearing, either electrical, hydraulic or mechanical, is necessary and the cost of this acts as an offset to the cheaper engines. There does not appear to be any great probability of a material reduction in the cost of large engines in the immediate future.

But provision for this "immediate future" is what American shipping now demands—if immediate expansion is to take place, it must be with vessels which are within the reach, financially, of the private shipowner. Therefore one feels that the Shipping Board should turn its attention to the development of vessels which the private owner can afford to buy—ships which will not, because of their great first cost, remain indefinitely in the possession of the Government.

Ship Steel

UNLIKE the steel used for other engineering structures, ship steel (that is, structural hull steel) has remained, in general of much the same quality for many years. While it is true that various alloy steels have been used in naval work, particularly in destroyers, and in certain very special commercial vessels, such as the *Mauretania,* for some time past, ordinary or commercial ship steel has retained much the same physical and chemical characteristics which it had twenty-five or more years ago.

During the past few years the modification of the steel used in the construction of bridges and similar structures with a view to reducing weight through the utilization of high-tensile material has been rapidly developed and now a similar modification of ship steel is receiving the serious attention of naval architects and steel makers, particularly in Great Britain and on the Continent of Europe.

At first glance, the relatively slow development of ship steel as compared with that of similar material for use on shore appears somewhat surprising. A little con-

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sideration of the methods made use of in the fabrication of the former and of the character of the stresses which it is called upon to withstand when in service at sea on the finished vessel will, however, serve to throw some light on the situation.

As has just been suggested, ship steel is subjected to two quite different forms of stresses—those due to the treatment it receives while being fabricated and built into the vessel and those created by the various forces which act upon the vessel after she has been placed in active service.

By far the larger portion of the steel entering into the construction of a ship is fabricated, or "worked," cold by means of punches, shears, presses and bending rolls. While the action of all these machines tends to harden the material and reduce its ductility, this effect is negligible except in the case of shearing and punching. Even with mild steel of the usual "ship" quality, shearing causes a quite perceptible hardening for some distance in from the edge—well within range of the first line of rivets in the butt or lap, as the case may be—and the punching of the rivet holes causes a still further hardening over the same area. The ductility of ordinary, good ship steel is so great that it can undergo a very considerable hardening without becoming brittle. It is this very desirable quality, which no doubt, has exercised a controlling influence over the classification societies and the shipbuilders themselves in their hesitancy to adopt steel of greater tensile strength with its accompanying possibility of more serious physical damage during fabrication.

Turning now to the stresses experienced by ships in service, we are confronted by the lack of accurate knowledge as to just what these amount to. It is customary to consider a ship as a beam irregularly loaded by the differences of weight and buoyancy throughout its length. This assumption, while sufficiently accurate for the comparison of the structural strength of one vessel with another, obviously cannot give the actual stress as it is not only based upon a condition of statical equilibrium which is impossible with a vessel in motion at sea, but also assumes a distribution of stress over the longitudinal members of the hull structure directly proportional to their distance from their collective neutral axis, a condition which can only be approximately true. The structural arrangements of a steel vessel are such that there are bound to be points where concentration of stress will occur, very probably amounting, under some conditions, to as much as the elastic limit of the material, or even more. Here again, the soft and ductile ship steel proves a most satisfactory material; for it has been found that this steel, when stressed slightly above the yield point and the load then removed, has a higher yield point than before. It would appear that the stressing above the yield point must, in the first instance, be accompanied by some permanent deformation so that what eventually takes place is an adjustment of stress over the whole structure in such a manner that it approaches, in effect, very closely to a simple beam.

Another essential quality of ship steel is the ability to undergo serious bending, twisting or other "permanent set" without rupture—such a condition as may result from collision or grounding. Only material of great ductility can meet this requirement and thus still another reason for the continued use of ordinary steel is made apparent.

Although ordinary ship steel has continued in almost universal use in commercial vessels up to the present time, the steady increase in the size of these vessels has made the production of some suitable material of high-tensile strength a most pressing matter. Owing to existing limitations of draft of water, the depth of large vessels has not been increased in the same proportion as their length, and, in consequence, sufficient structural strength can be maintained only by a disproportionate increase in hull weight, assuming, of course, that the tensile strength of the steel remains the same. In other words, for ships of extreme size, the weight of hull can be kept within reasonable bounds only by the use of high-tensile steel.

Alloy steels have the disadvantage of greater cost but this can probably be met, provided the higher ultimate strength and elastic limit are not obtained at the cost of losing those most essential qualities of being able to withstand working cold without becoming brittle and of retaining sufficient ductility to withstand permanent bending and distortion without rupture.

That this problem is in a fair way of being solved is indicated by the report of the production of a satisfactory "high-elastic limit" steel in England of which several vessels have been constructed and of the use of similar material in Italian and German shipyards.

The greatest deficiency of ordinary ship steel lies in its inability successfully to resist corrosive action and the necessity of keeping it constantly and thoroughly covered with paint or other protective coating. To insure against the inroads of corrosion, the various classification societies require an increase in scantlings of approximately 10 percent above what is demanded by considerations of strength alone. This in itself constitutes a very appreciable increase in first cost and in hull weight which has to be carried, to say nothing of the upkeep and maintenance costs which corrosion thrusts upon the shipowner.

Corrosion in steel structures ashore is being met by the use of copper-bearing steel and this material is reported to have been adopted in certain ships abroad. Provided suitable rivets are used, it may be employed in ship construction but from experience in this country where copper-steel had inadvertently found its way into shell plating and set up violent electrolytic action with ordinary soft steel rivets, it would appear that when in permanent contact with salt water its use might cause serious damage. Rustless nickel steel is also being used for many purposes ashore but its great cost would seem to preclude its extensive adoption in commercial shipbuilding. That a practicable rustless steel would be an enormous boon to the shipowner goes without saying, and one can only hope that metallurgy will eventually produce such a material, thereby adding another to the long list of debts owed to it by shipping.

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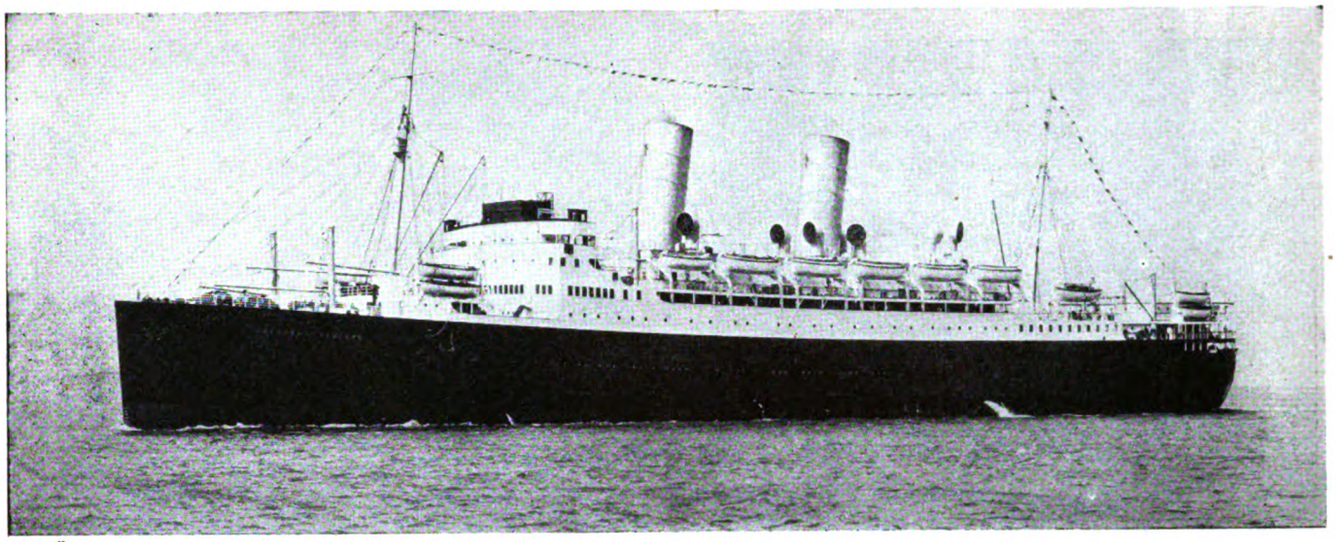


Canadian Pacific passenger steamship, Duchess of Bedford, built for the company's North Atlantic service

Passenger Liner Duchess of Bedford

First of four sister ships with geared turbine drive built for Canadian Pacific Steamships, Ltd.

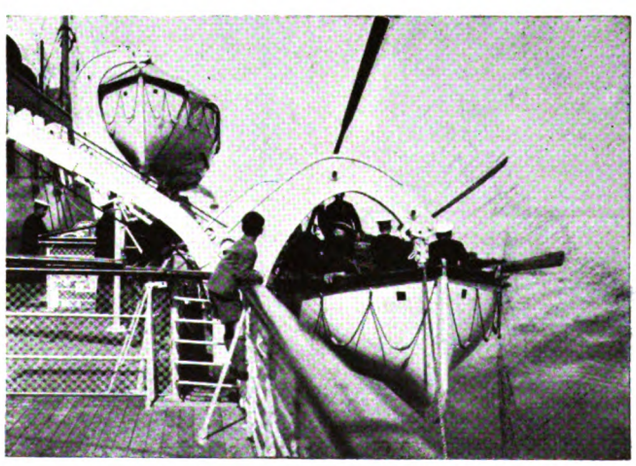
THE twin-screw, geared-turbine drive passenger and cargo steamship *Duchess of Bedford,* which was placed in the North Atlantic service of the Canadian Pacific Steamships, Ltd., during the past season was built by John Brown & Company, Ltd., Clydebank, Scotland. This vessel is the first of four sister ships to be completed. Two others, the *Duchess of Richmond* and the *Duchess of York,* are nearing completion by the John Brown & Company, Ltd., while the third ship, the *Duchess of Athol,* was built at the Dalmuir yard of William Beardmore & Company, Ltd. The latter vessel was placed in operation a short time ago, while the *Duchess of Richmond* and the *Duchess of York* will not go into active service until next year.

The outstanding feature of the *Duchess of Bedford* from an operating standpoint is the remarkable performance of the vessel both on her trials and in service. On the trial trip the guaranteed fuel consumption of 0.70 pound of fuel oil per shaft horsepower hour for all purposes was obtained with a substantial margin, while the fuel rate on the maiden voyage was a considerable improvement over this figure. In fact, on the return run from Canada on this voyage the fuel consumption for all purposes amounted to only 0.62 pound of fuel oil per shaft horsepower hour and for propulsion alone to 0.58 pound. These vessels have the following main characteristics.

Length overall	600 feet
Beam, molded	75 feet
Depth to bridge deck	53 feet
Load draft	27 feet
Gross tonnage	21,500
Shaft horsepower	20,000
Service speed	17½ knots
Number of passengers:	
Cabin class	600
Tourist, third class	500
Third class	500
Crew and staff	409
Total complement	2009

The *Duchess of Bedford* design is characterized by a straight stem and cruiser stern with two funnels and two masts rigged as a fore-and-aft schooner. Complete subdivision of the hull has been carried out to conform to the Board of Trade requirements and according to the recommendations of the International Convention for Safety of Life at Sea. The requirements of Lloyd's Register of Shipping have been followed to meet the highest classification, 100-A1 under a special survey. The vessel also complies with the latest laws relating to passenger steamships of the United States and Canada.

The hull is arranged with eight decks consisting of the boat, promenade, bridge, shelter, upper, main, lower and orlop decks. The boat and promenade decks extend for about three-quarters of the vessel's length amidships. The bridge, shelter, upper and main decks extend the en-



Lifeboat drill

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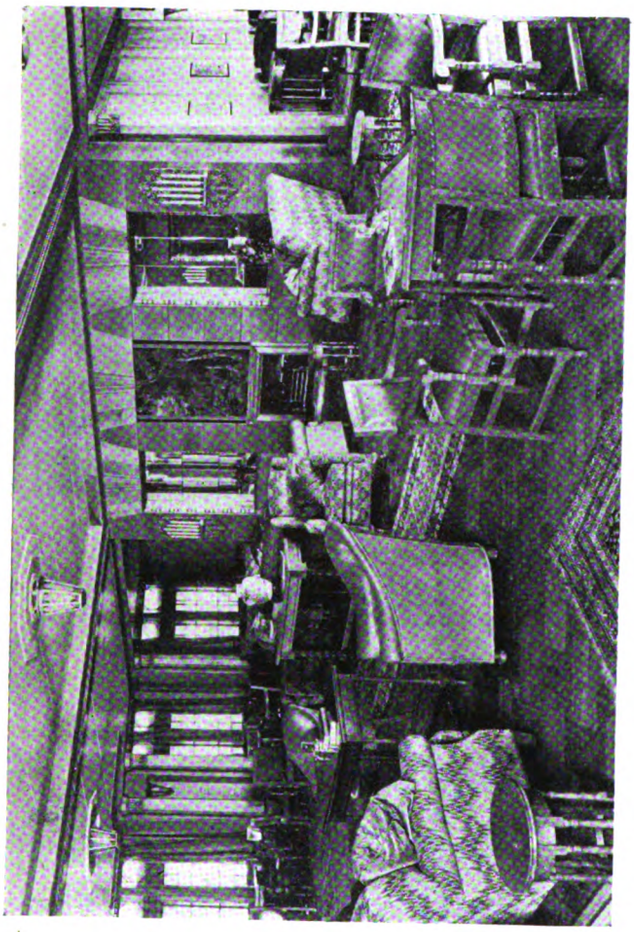
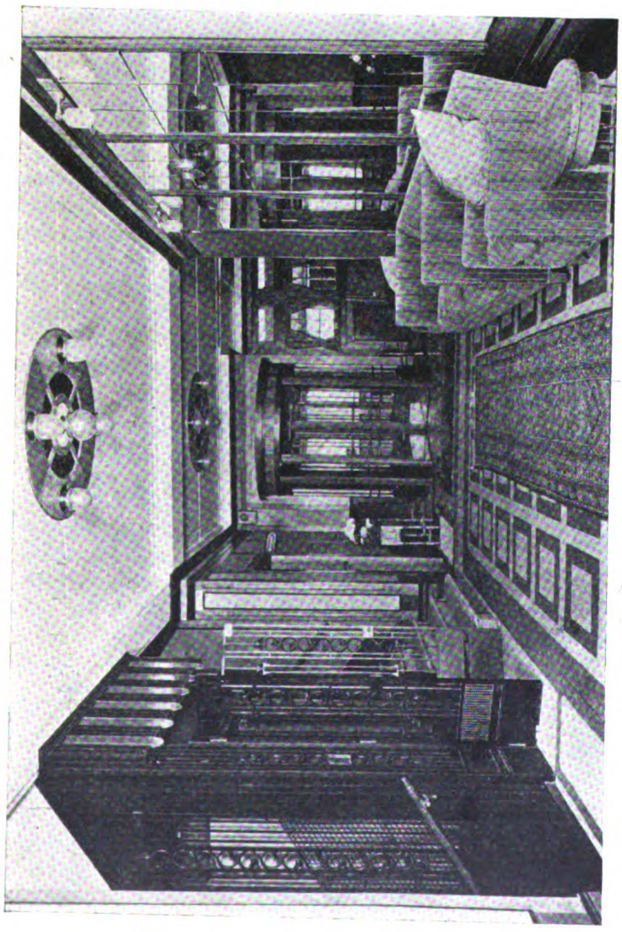
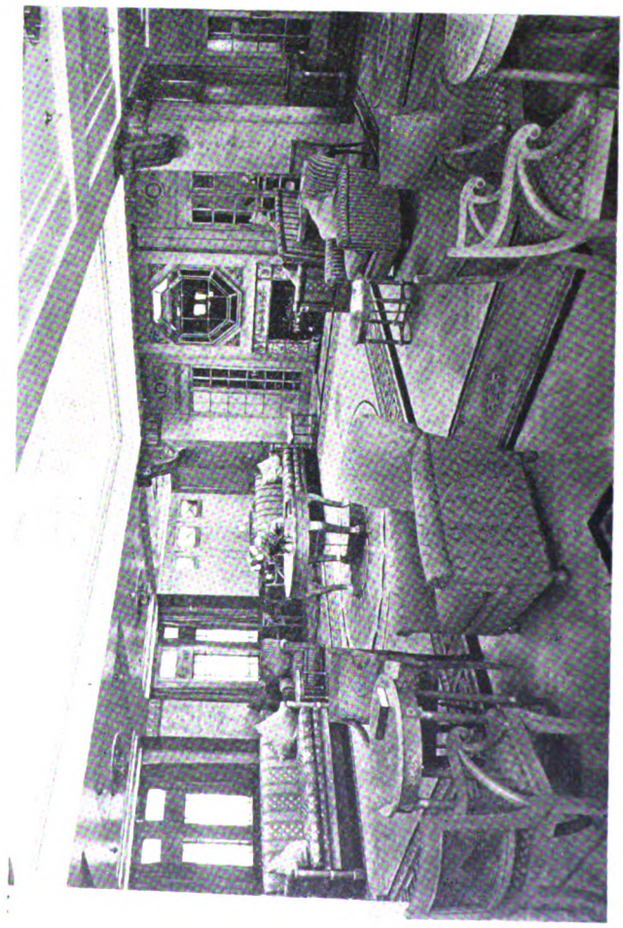


Smoking room

Dining room



Cabin entrance on promenade deck



Lounge

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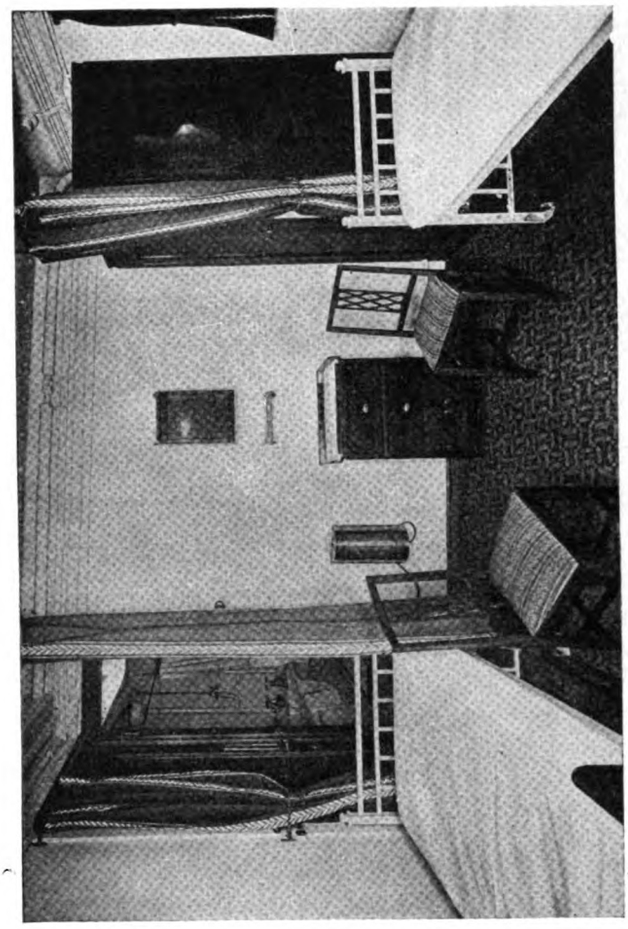
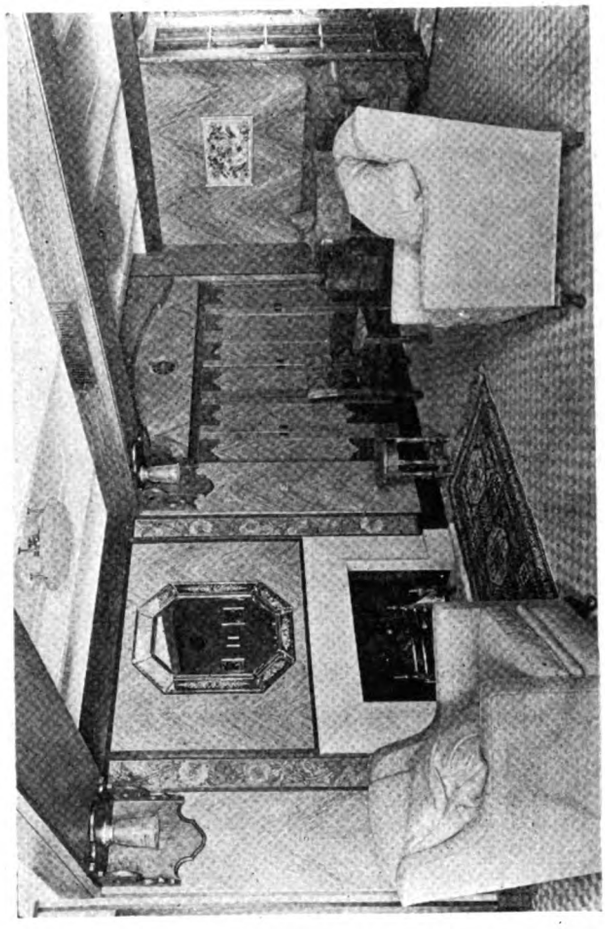
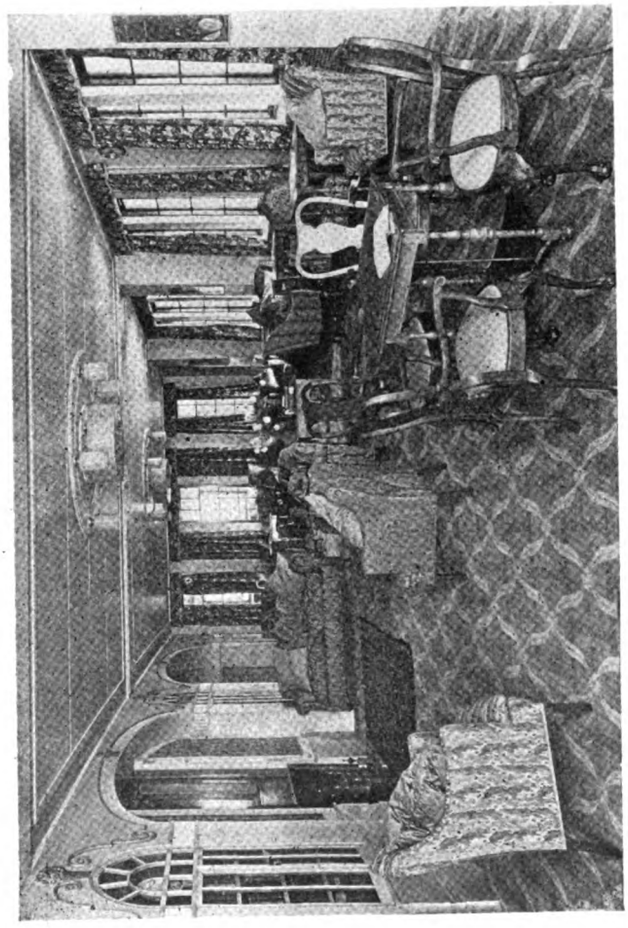


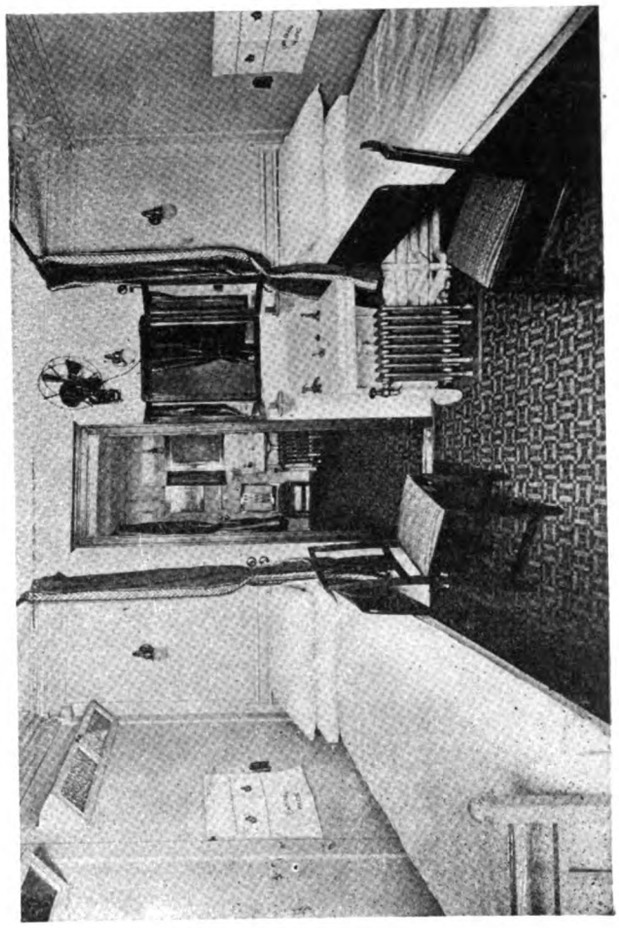
Cabin-class stateroom with bath



Writing and card room



Observation room



Cabin-class stateroom

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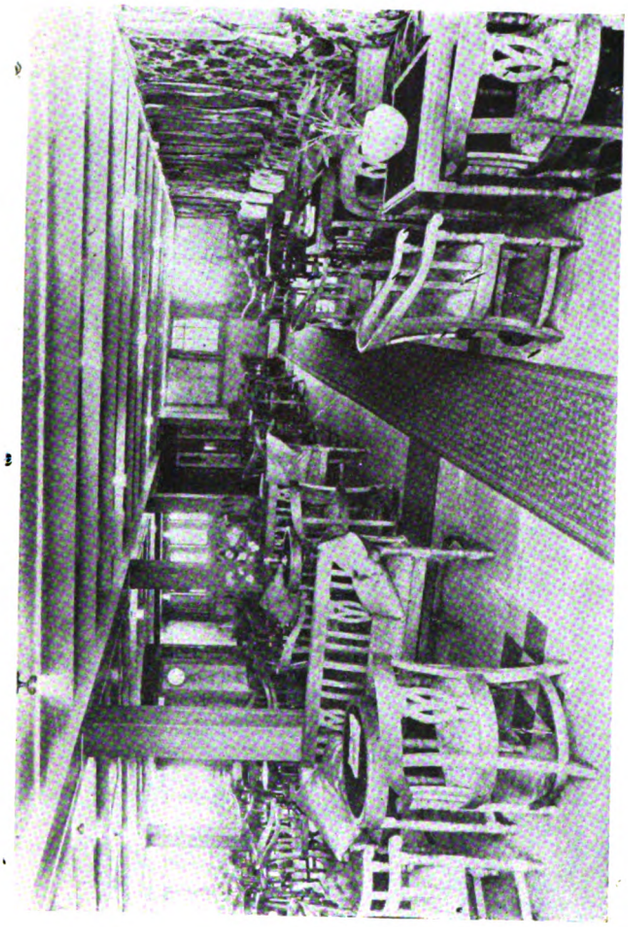
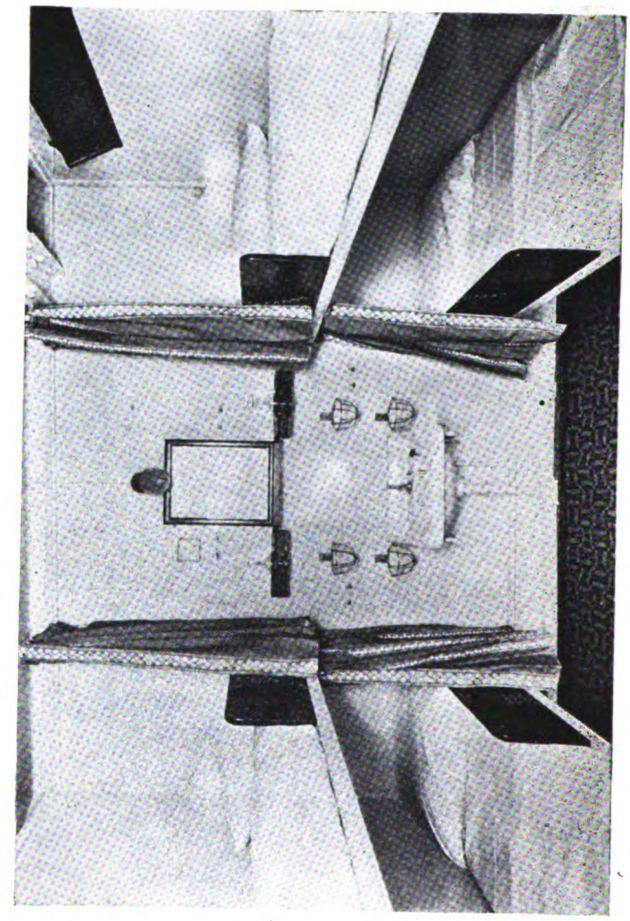
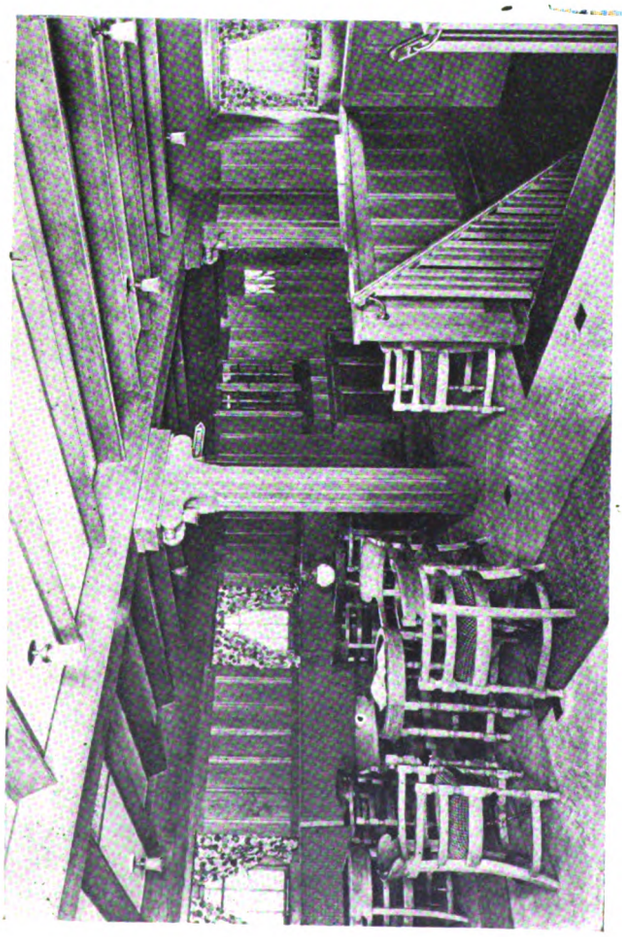


Tourist third-cabin lounge



Tourist third-cabin stateroom



Third-class lounge

Children's playroom

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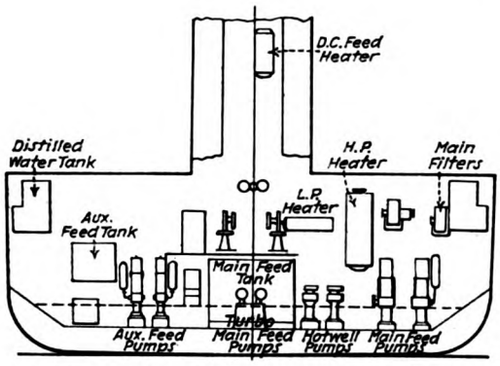
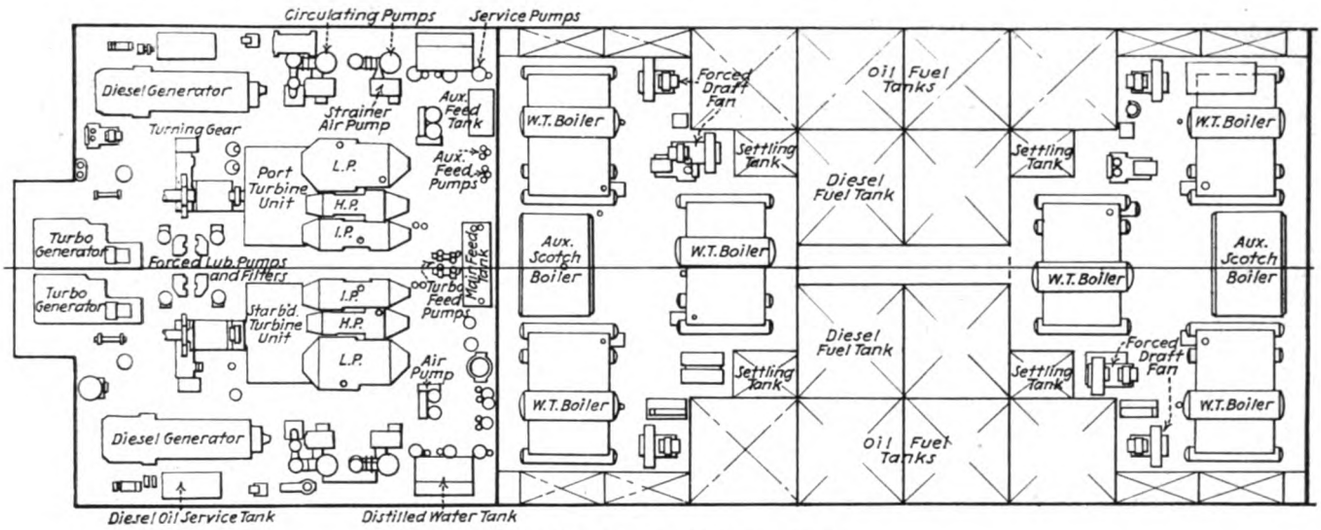
tire length of the the vessel, while the lower and orlop decks extend to the ends fore and aft from the machinery spaces.

Propelling Machinery

The main propelling machinery, consisting of two sets of Parsons-type single-reduction geared turbines, delivering a total of 20,000 shaft horsepower, was supplied by the builders. A Weir regenerative-type condenser is bolted directly to the under side of each low-pressure turbine. Reversing is accomplished by means of astern blading in the intermediate and low-pressure turbine casings, about 13,000 shaft horsepower being developed for this purpose. Each turbine is geared to a 4-bladed bronze propeller supplied by the Manganese Bronze & Brass Company, Ltd. The two propellers, which are of aerofoil section, have diameters of 18 feet 9 inches with a pitch of 17 feet 6 inches.



Section at forward engine room bulkhead



Plan of engine and boiler rooms

Steam is supplied to the main and auxiliary machinery by six Yarrow boilers and two Scotch marine-type boilers. These boilers are arranged in two boiler rooms, each containing three watertube and one Scotch type. The watertube boilers are utilized to supply superheated steam to the main turbines at a pressure of 370 pounds per square inch and a total temperature of about 680 degrees Fahrenheit. The steam-driven auxiliaries are supplied with steam by the Scotch boilers at 200 pounds per square inch pressure.

Combustion air is preheated in multitubular air heaters to 320 degrees Fahrenheit before entering the furnaces, while the feed water is delivering to the watertube boilers at a temperature of about 300 degrees Fahrenheit by means of a direct-contact and a live-steam feed heater in the circuit. The Wallsend-Howden system of oil firing is used on all boilers and, in addition, the watertube boilers are provided with forced draft on the Howden system.

Economy Due to High Thermal Efficiency

This remarkably low fuel rate of 0.62 pound of oil per shaft horsepower hour realized by the *Duchess of Bedford* is due to a number of different factors that enter into the design and arrangement of her machinery. High pressure and high superheat are utilized in efficient turbines and generating units. This is the basis for the successful operation of the ship. Another factor in obtaining the overall economy is the extensive use of electrically-driven auxiliaries.

Every precaution known to insulating engineers has been taken to prevent heat losses in the piping or in the machinery itself. The system of preheating combustion air and also the feed-water arrangement insure heat savings. The make-up feed water for the watertube boilers is taken from the Scotch boilers so that by the use of distilled water all impurities in the main boilers may be avoided. By means of the double boiler system, the high-pressure, high-temperature steam developed in the watertube boilers is efficiently utilized in the propelling machinery, while the low-pressure steam developed by the two Scotch boilers is advantageously used by certain steam-driven auxiliary machinery and for heating.

Auxiliary Equipment

The main air pumps, main feed pumps and auxiliary feed pumps, which are all steam driven, were supplied by G. & J. Weir, Ltd. The main circulating pumps, however, are electrically driven as is also the case with the majority of the engine-room pumps. The motor equipment for driving the auxiliaries was supplied by the Laurence Scott Company, while the pumps used for sanitary and other service are of the Drysdale-Centrex type.

At the after end of the engine room between the propeller shafts are located two 500-kilowatt British Thompson-Houston geared-turbine generator sets. On a gallery above them the main switchboard is located. In addition, there are two Allen-Burmeister & Wain

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450-kilowatt 6-cylinder Diesel engine-driven generator sets with their auxiliaries which are located in the outer wings of the engine room aft.

Heating throughout the accommodations of the vessel is carried out on the low-pressure system with supplementary electric heaters provided in the cabin accommodations. Mechanical ventilation was supplied by Thermotank Limited of Glasgow.

Practically all the auxiliary machinery on the vessel outside the engine room is electrically operated including the steering gear, cargo and boat winches, windlass, capstans, forward and aft, and refrigerating machinery.

The vessel is fitted with the Lux flooding installation for protecting the boiler rooms against oil fires as well as Lux hand-operated hose reels for dealing with local fires in the various compartments. This equipment was supplied by Walter Kidde & Company, Inc., of London.

Passenger Accommodations

The entire scheme of decorations throughout the *Duchess of Bedford* is one of extreme simplicity. European woods and wood from the Canadian forests, either in natural or lightly waxed finish, have been utilized to a great extent.

The main entrance hall is located on the upper deck, an elevator and stairway providing access from it to the promenade deck. The dining saloon, which will accommodate 300 persons at tables arranged for two or six, is on the upper deck. The lounge, smoking room, drawing room and card and writing room are situated on the promenade deck while the gymnasium and nursery are on the boat deck.

Staterooms for cabin passengers are located on the boat, bridge, shelter and upper decks and will accommodate from one to four persons. Each stateroom is fitted with cot bedsteads, wardrobes, dressing tables and the like, and are equipped with hot and cold water lavatories. Provision is made for the transformation of certain of these rooms into sitting rooms for use in suites, in which case private bathrooms are located adjacent to them.

The cabin-class lounge is finished in silver gray sycamore panels with cerise, cream and green furnishings in the Empire style. Except when used as a ballroom, the floor, which is of parquet work, is carpeted. An appearance of height is given to the lounge by carrying the walls several feet above the boat deck so that the upper parts of the windows take light from this deck and not from the deck immediately below.

The same scheme has been followed in the cabin-class smoking room where light is also taken from the upper deck.

In the dining saloon, the general scheme of decoration is gray oak with panel effects in red leather studded with bronze nails. An exaggerated dome effect has been accomplished in the dining saloon by means of radiating panels in the center of the ceiling. A large Chinese lantern is utilized in the center of this dome for lighting and to harmonize with other similar lanterns located around the walls.

Third-Class Accommodations

Particularly spacious and comfortable accommodations are provided on the *Duchess of Bedford* for tourist-third-class passengers, which service is rapidly becoming one of the features of North Atlantic travel. The cabins for these passengers are situated at the after end of the ship on the shelter, upper and main decks, the rooms being arranged to accommodate two or four persons. The dining saloon for this class is on the upper deck immediately aft of the cabin dining saloon, and will seat 252 persons at tables arranged for two to six diners. A stairway leads from the upper to the shelter and bridge decks where the entrance hall, lounge and nursery are located. From the illustrations, an idea may be gained of the comfortable quarters provided for passengers of this class.

The third-class accommodations are arranged in the forward and after ends of the vessel on the upper, main and lower decks. The cabins in this case are arranged for two, four or six persons. The public rooms for third-class passengers include a lounge at the forward end of the bridge in the deck house, a smoking room on the shelter deck and a dining room amidships on the main deck. Provision is made in this room to seat 250 passengers at tables arranged for four, six or eight persons.

The kitchen, bakery and steward's department equipment of the vessel was supplied by Henry Wilson & Company, Ltd. of Liverpool. Electric ranges, heaters, dish-washing machines, and the like, are largely utilized in the service department.

Program of Naval Architects' Annual Meeting

THE thirty-sixth general meeting of the Society of Naval Architects and Marine Engineers will be held in the Engineering Societies Building, 29 West 39th Street, New York, on Thursday and Friday, November 15 and 16. The professional sessions will begin at 10 a.m. each day and the annual banquet will be held in the Grand Ball Room of the Waldorf-Astoria hotel on Friday evening, November 16 at 7:30 o'clock.

Prior to the general meeting, the council of the society will meet at 3 p.m. Wednesday, November 14, in the Board Room on the 15th floor of the Engineering Societies Building.

The following papers will be read at the professional sessions of the society:

Thursday, November 15

"The Scientific Application of Welding to Ship Construction." By James W. Owens.

"Recent Developments in Shipbuilding on the Great Lakes." By Albert W. Cross.

"Some Observations on the design of Airplane Carriers and Notes on the *Saratoga* and *Lexington*." By Rear Admiral George H. Rock, (C.C.), U. S. N.

"Design of a Large Flying Boat." By Captain Holden C. Richardson, (C.C.), U. S. N.

"The Inclining Experiment." By Rear Admiral John G. Tawresey, (C.C.), U. S. N., Retired.

"Propeller Backing Power in Tugboats." By Alfred J. C. Robertson.

Friday, November 16

"Development of Pulverized Fuel for Marine Purposes During 1927-1928." By Carl J. Jefferson, Commander Joseph S. Evans, U. S. N., and Commander Joseph Brosheck, U. S. N.

"The Burning of Hydro-Carbons Under Marine Boilers." By Ernest H. Peabody.

"Forced-Blast, Chain-Grate Stoker Tests of a Marine Water-tube Boiler." By Thomas B. Stillman.

"Turbine Electric Drive as Applied on the Great Lakes Cargo Ships." By C. R. Fisher and A. Kennedy, Jr.

"The Central Power Station Goes to Sea." By Commander Quincy B. Newman, U. S. C. G.

"Description and Trials of the *California*." By Captain Roger Williams.

"Performance of the Converted Motor Vessels of the U. S. Shipping Board." By Captain Richard D. Gatewood, (C.C.), U. S. N.

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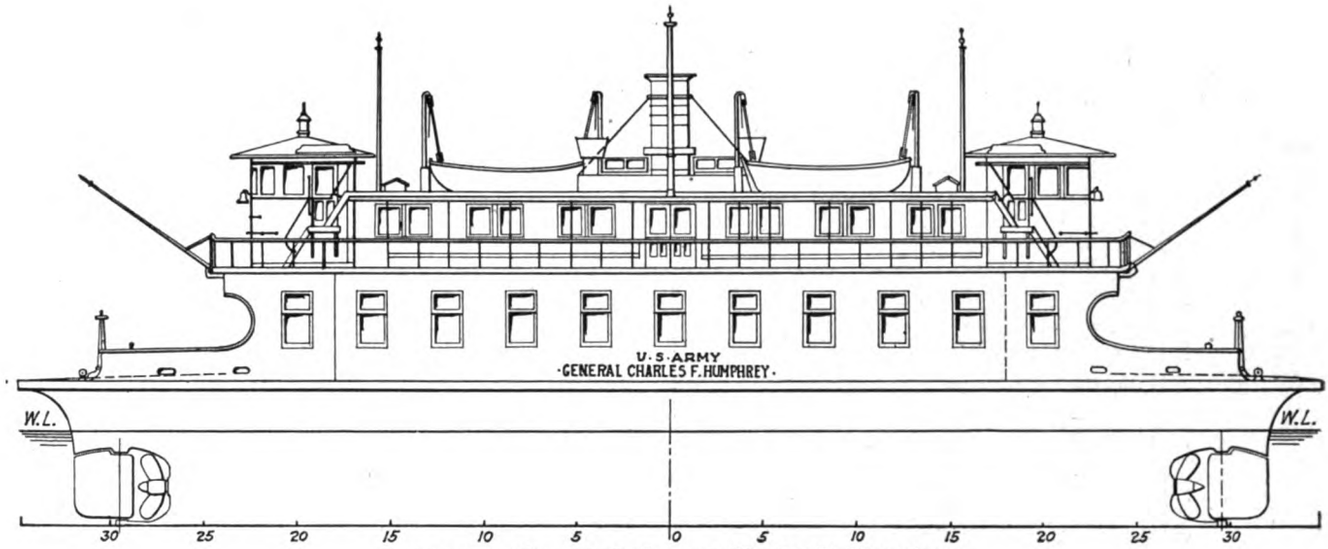


Outboard profile: M. S. General Charles F. Humphrey

New Governors Island Ferryboat

Double-ended steel Diesel-driven ferryboat built for army service in New York Harbor

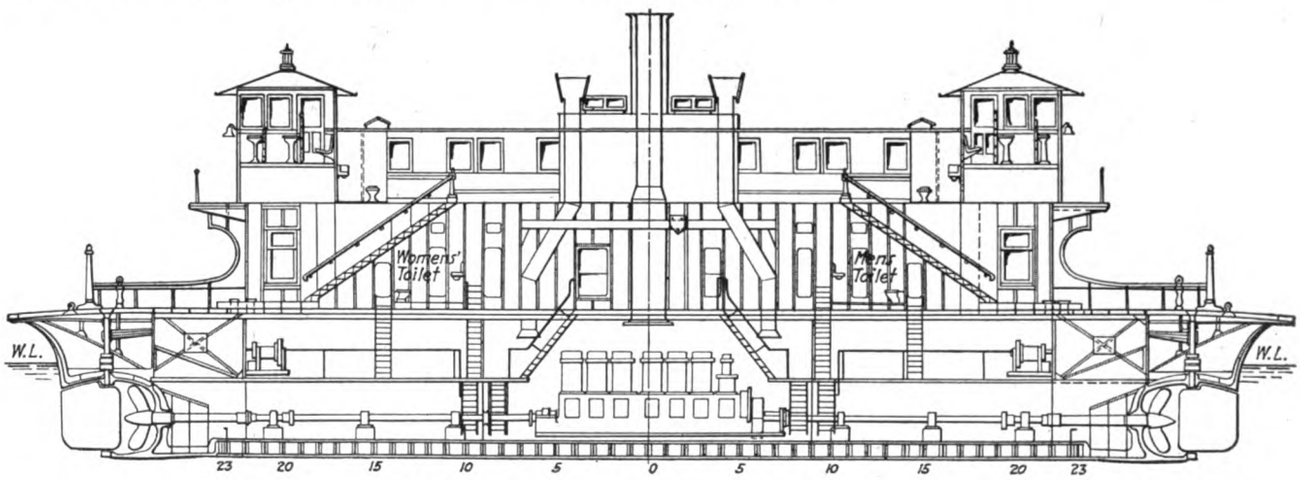
THE Quartermaster's Corps, War Department, at Governors Island, New York, has recently taken delivery of the double-ended steel ferryboat, *General Charles F. Humphrey,* which was built by the Spear Engineers Corporation, Norfolk, Va. The design for this ferryboat was prepared by Frank Van Vleck, supervising marine engineer at the office of the Quartermaster General, Washington, D. S. The principal dimensions of the ferryboat are as follows:

Length over guards	128 feet
Length on waterline	118 feet
Breadth over guards	44 feet
Depth of hull at side, molded	14 feet 6 inches
Depth of hull at center, amidships	15 feet 2 inches
Draft in light service condition	8 feet 6 inches

The hull of this vessel was designed on as straight-lined cross sections as possible in order to afford ease of construction and at reduced cost. Most of the frames are practically straight but with an easy turn at the bilge. The main portion of the vessel consists of a deck house with steel sides which encloses the main deck space and side cabins. The center space on the main deck is arranged in two gangways for the accommodation of vehicles. Double-swinging steel doors are provided to enclose the driveways in inclement weather when desirable. The driveways and open ends of the vessel are decked with grooved steel pavement while the side cabins are decked with concrete pavement laid in small squares.

The amidship deck house is finished as a men's cabin on one side of the vessel and as a women's cabin on the other. On the upper deck are located the saloon and pilot houses. A portion of the saloon is arranged as an officer's cabin with toilet rooms adjoining. The floor of this cabin is covered with inlaid linoleum while the steel walls are finished in white.

As typical with double-ended ferryboats, a separate pilot house is located at each end of the vessel on the upper deck. Settees are arranged outside the cabin on this deck.



Inboard profile: M. S. General Charles F. Humphrey

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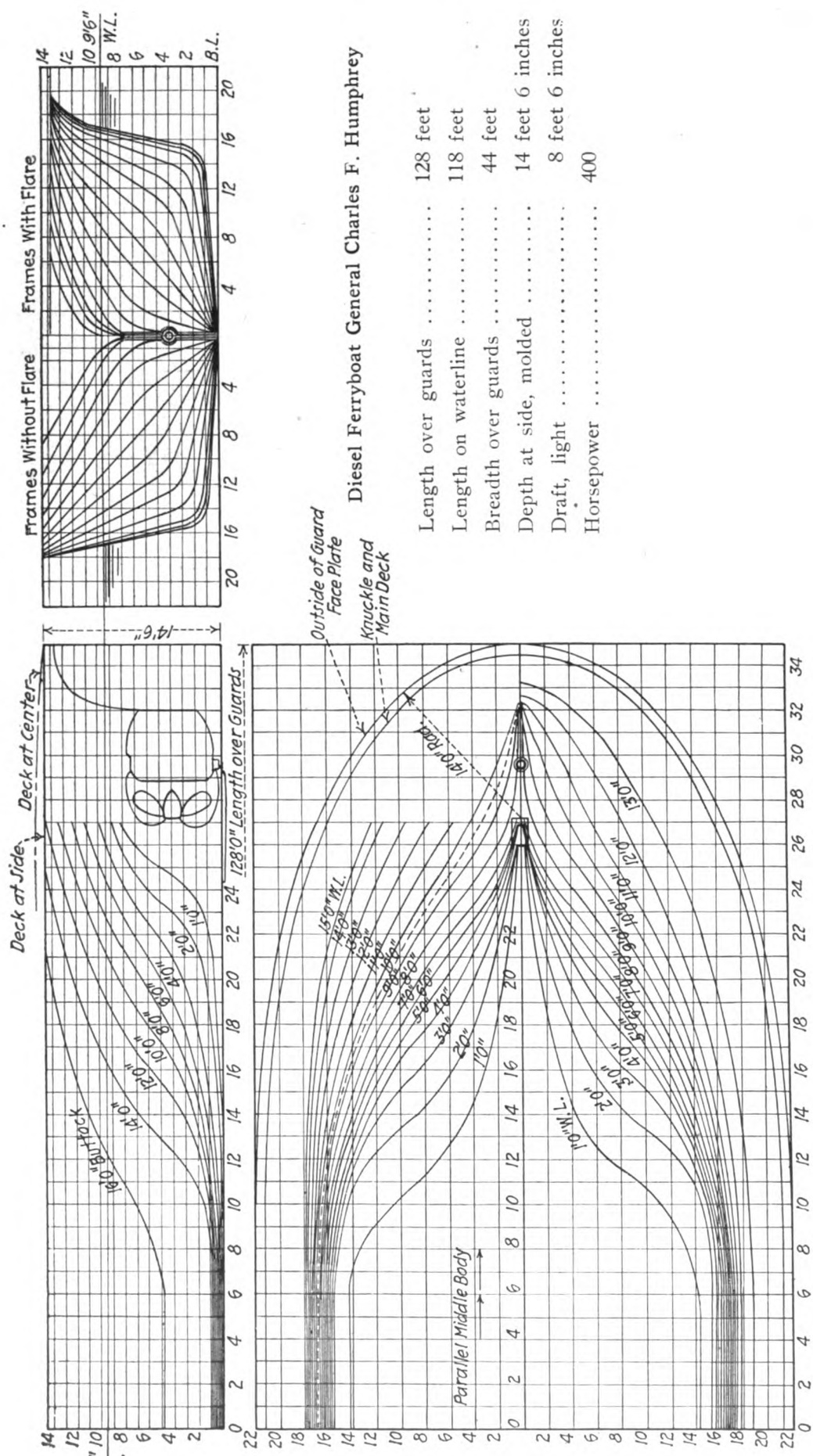

Diesel Ferryboat General Charles F. Humphrey

Length over guards	128 feet
Length on waterline	118 feet
Breadth over guards	44 feet
Depth at side, molded	14 feet 6 inches
Draft, light	8 feet 6 inches
Horsepower	400

Lines of the hull

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Propelling Machinery

The main propelling machinery consists of a 6-cylinder 2-cycle Diesel engine rated at 400 horsepower built by Fairbanks, Morse & Company, Chicago, Ill. This engine is located amidships and is connected through a clutch to a propeller at each end of the vessel. The spaces in the hull forward and aft of the machinery department are arranged for use as storage holds. The lamp, paint and oil locker are also located in the hold separated from the storage space by bulkheads.

Direct mechanical means for controlling the engine from the pilot house are provided so that all maneuvering can be carried out by the pilot.

Auxiliary power for light and motor current is provided by two 30-kilowatt Diesel engine-driven generator sets supplied by Fairbanks, Morse & Company, Chicago, Ill.

The auxiliary equipment installed on the ferryboat includes:

1 Fairbanks-Morse 4-inch centrifugal fire pump, having a capacity of 350 gallons per minute at 100 pounds per square inch pressure. This pump is driven by a 40-horsepower General Electric motor.

1 Fairbanks-Morse horizontal duplex bilge pump, 5¾ inches by 6 inches, having a capacity of 100 gallons per minute at 50 pounds per square inch pressure. This pump is driven through gearing by a 7½-horsepower General Electric motor.

1 Fairbanks-Morse 2-inch centrifugal sanitary pump, having a capacity of 100 gallons per minute against an 80-foot head. This pump is direct connected to a 5-horsepower General Electric motor and is fitted with a Cutler-Hammer pressure regulator.

1 Fairbanks-Morse 1½-inch centrifugal fresh water pump having a capacity of 40 gallons per minute against an 80-foot head. This pump is direct connected to a 2-horsepower General Electric motor and is fitted with a Cutler-Hammer pressure regulator.

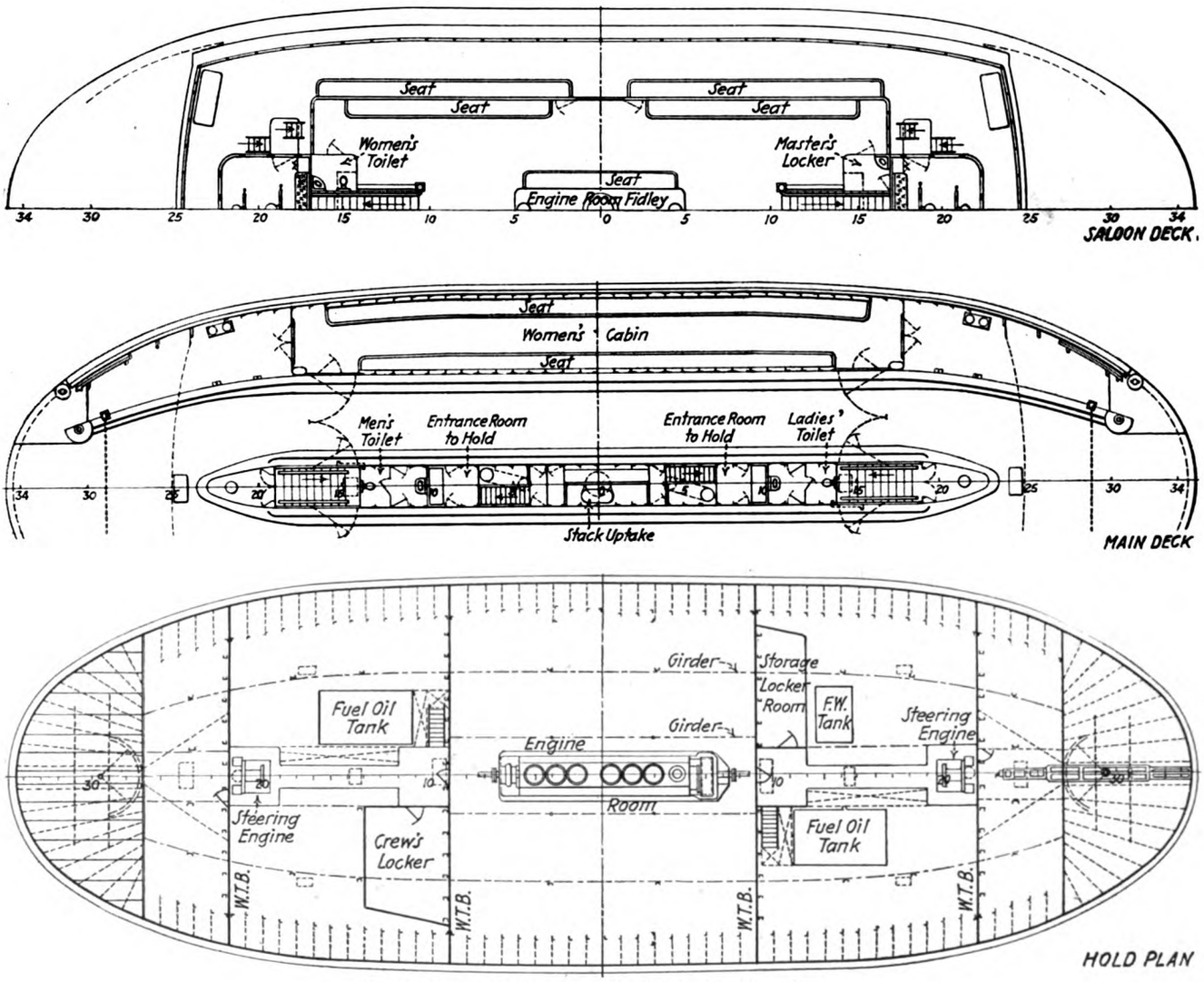
1 Worthington 5-inch by 6-inch horizontal simplex circulating pump having a capacity of 100 gallons per minute against a 60-foot head. This pump is driven through gearing by a 5-horsepower General Electric motor.

1 Worthington rotary fuel oil transfer pump having a capacity of 20 gallons of oil per minute at 15 degrees Beaumé against 100 pounds per square inch pressure. This pump is direct connected to a 2-horsepower General Electric motor.

1 Worthington two-stage air compressor, having a capacity of 52 cubic feet of free air per minute against 225 pounds per square inch pressure. The compressor is driven by a 20-horsepower General Electric motor.

1 Almy watertube heating boiler having 335 square feet of heating surface and equipped with an Aetna automatic oil burner.

2 American Engineering Company, type B, drum-type electric steering gears controlled by a Cutler-Hammer non-magnetic master and helm-angle indicator located in the pilot houses.



Deck plans: M. S. General Charles F. Humphrey

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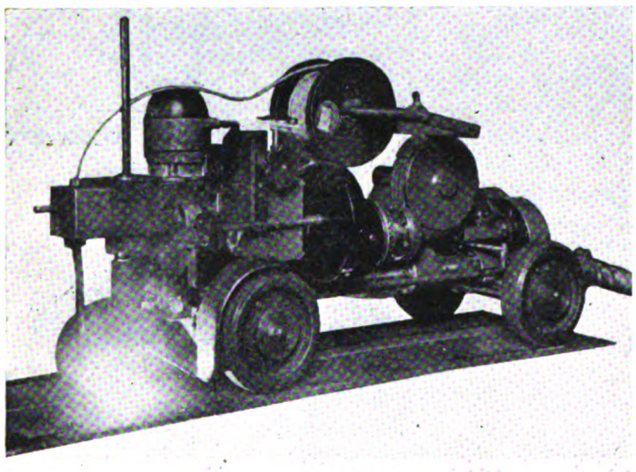
Tractor Type Electronic-Tornado Welder

An automatic tractor-type arc welder utilizing the electronic-tornado principle and used for making lap welds and butt welds on large tank bottoms, roofs, large pipe and on similar work, has been placed on the market by The Lincoln Electric Company, Cleveland, Ohio. The machine consists of an electronic-tornado head mounted on a self-propelled, four-wheel-drive carriage. Power is supplied through a flexible cable.

All that is necessary to place the machine in operation is to line it up over the seam to be welded and to start the arc, the electrode and fibrous autogenizer being fed automatically as the tractor travels forward.

In making lap welds with this machine no additional filler metal is used. The heat of the carbon arc fuses the edge of the top plate into the lower plate making a leak-proof joint. A filler strip is laid over the seam to be welded when a butt weld is desired.



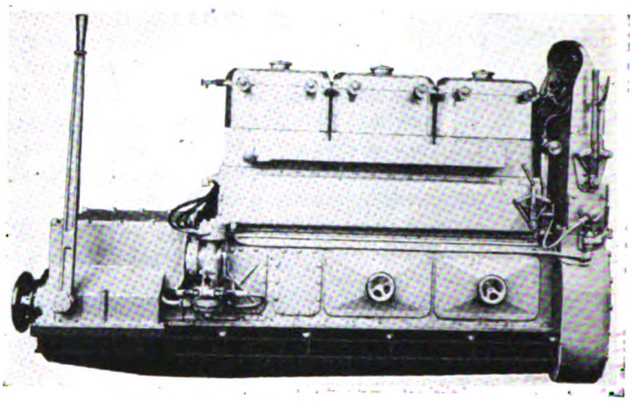
Tractor-type automatic arc welder

The chief advantages claimed for this machine are high welding speeds and smooth uniform welds. Speeds on ¼-inch lap joints varying from 50 to 75 feet per hour are obtained.

Winton Develops New Design Light-Weight Diesel Engine

The Winton Engine Company, Cleveland, Ohio, has developed a new type Diesel engine for marine use that is available in a 4-cylinder 60 to 100-horsepower size and in a 6-cylinder, 150-horsepower model. This engine is of the 4-cycle airless injection design and occupies about the same space as a gasoline engine of the same power. It is light in weight and in the 6-cylinder model develops its rated power at 750 revolutions per minute. The cylinders for both size engines have a bore of 7 inches and a stroke of 8½ inches. The 4-cylinder model develops 60 horsepower at 450 revolutions per minute and 100 horsepower at 750 revolutions per minute.

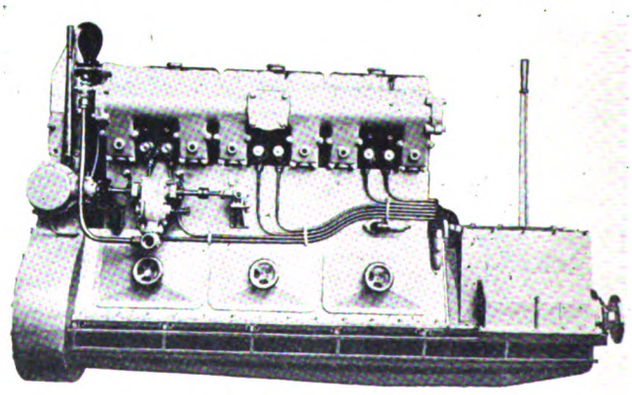
In order to reduce the weight, special iron, steel and alloys have been used throughout the construction. The cylinder block is a one-piece casting of chrome-nickel iron. Into this casting are inserted chrome-nickel-iron cylinder liners which are machined and ground smooth and may easily be removed. The top crank case is made of special aluminum alloy in one piece and is cast with stiffening ribs to insure rigidity. The bottom crank case is of chrome-nickel iron with an extension aft to accommodate the clutch and thrust bearing.



Inlet side of new Winton Diesel engine

The cylinder heads and cylinder-head covers are readily detachable. The pistons are made of nickel-copper-aluminum alloy while the wrist pins are made of chrome-nickel steel, hollow bored, hardened and ground. Chrome-nickel steel of high-tensile strength is also used for the crank shaft, which is 4 inches in diameter.

The connecting rods are of chrome-molybdenum, electric-furnace tested steel. The intake and exhaust valves in the cylinder head, which are enclosed by oil-tight covers, are made from special silchrome-alloy steel. Chrome-nickel steel, drop-forged rocker arms fitted with bronze bushings operate on top of the cylinder heads by means of push rods actuated by the cam shaft. The push rods are of seamless nickel-carbon unannealed steel tubing while the cam shaft, of the built-up type, consists of a carbon-steel shaft fitted with molybdenum-steel cams. The water pump is of the gear type and the lubricating pump is of the duplex type. The engine is fitted with a Winton standard air starter with a forced-feed type oiling system. The engine is fitted with a special planetary-type reverse gear.



Exhaust side of 150-horsepower Winton engine

Two of the new type 150-horsepower engines are installed the houseboat *Day Dream*, recently built by the Mathis Yacht Building Company, Camden, N. J., for Senator W. H. Reynolds of New York City.

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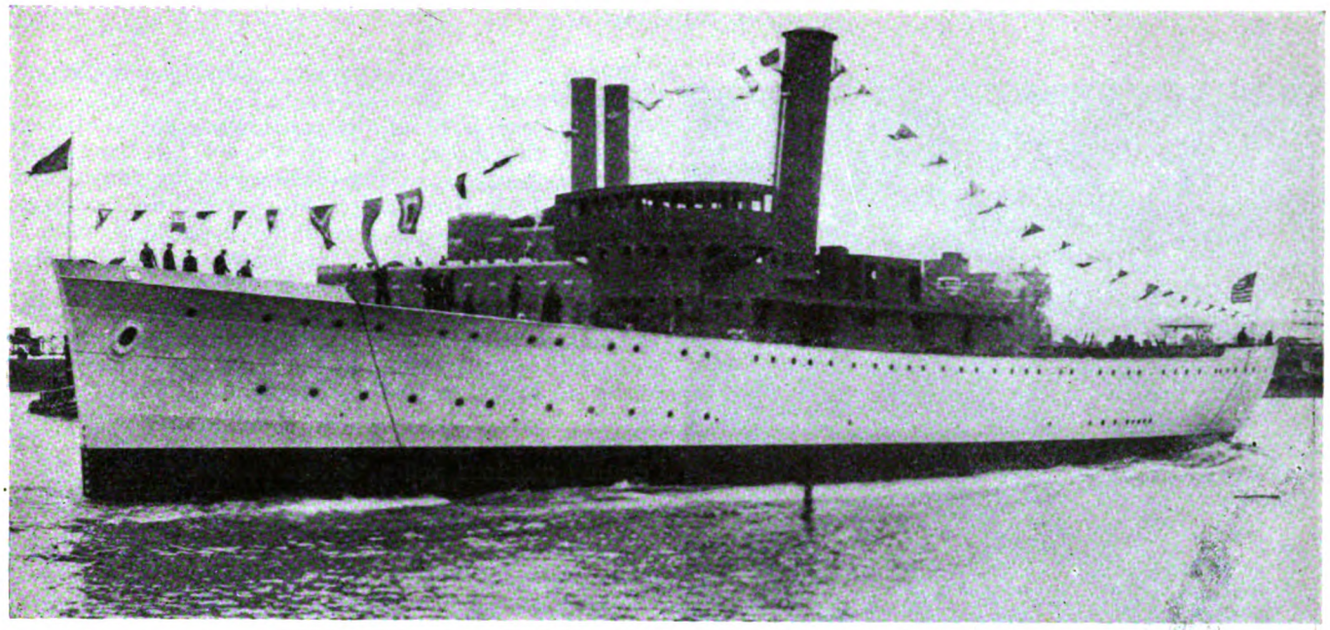

Coast Guard cutter Chelan after launching at Fore River Plant of Bethlehem Shipbuilding Corporation, Ltd.

Turbo-Electric Coast Guard Cutters

Main turbo-generators supply complete power requirements of propelling and auxiliary machinery

By H. C. Coleman*

EVER since the establishment of the United States Coast Guard Service it has included in its personnel men of a distinct pioneering character. One of the most outstanding pioneers of the present service is Captain Q. B. Newman, formerly engineer-in-chief of the Coast Guard. Largely as a result of his untiring effort the Coast Guard is now putting into service, five fine new cutters.

It is in the layout of the propulsion and auxiliary plants in the cutters that Captain Newman has done his latest pioneering and departed from the usual ship power-plant arrangement. The fundamental thought in this arrangement might be termed the "central station" or "central power-plant" idea. In other words, the aim was to get an installation where not only the propulsion power but also all auxiliary power might be taken from the main turbine, in order to utilize the higher economy of the main turbine, for supplying the complete power requirements of the vessel. Having been worked out on such a basis the new Coast Guard Cutters are unique, and it is believed their operating records will be watched with great interest by all shipping circles.

The first of these five Coast Guard cutters, the *Chelan,* has recently been placed in commission. She has an over-all length of 232 feet 6 inches, a beam of 34 feet 6 inches, a normal draft of 14 feet 6 inches and a displacement of 2000 tons. These vessels have fine lines and make a good appearance.

It will be interesting to examine the power plant of this cutter. The ship is propelled by a 3000 horsepower, 2300-volt, 3-phase, 60-cycle, 44-pole synchronous-type motor turning at 163½ revolutions per minute, which receives power from one main turbo-generator unit, the generator being rated at 2600 kilowatts when running at 3600 revolutions per minute. With normal ship load this plant will give the vessel a speed of 16½ knots at full power.

Propelling Motor

The propelling motor is of the bracket type, the brackets supporting marine-type disk lubricated bearings, which insure positive lubrication regardless of speed or direction of rotation of the motor. The space between the bracket arms is covered by heavy mesh screens. Ventilating air enters the motor through these screens and discharges through a flange at the top of the frame. An exhaust blower with a capacity of 10,000 cubic feet per minute, driven by an 18 horsepower, alternating-current motor, is connected to the air duct at the top of the propelling motor, and exhausts the warm air from the motor through a ventilator on deck. The collector rings and brush rigging are mounted outside the bracket and bearing housing at the end opposite the coupling end of the motor. The motor field poles are provided with a pole face or a mortisseur winding to give the motor induction-motor characteristics for starting and maneuvering.

Main Turbo-Generator

The main turbo-generator unit is of the three-bearing type. The generator rotor is a solid forging with radial slots, mica insulation of the finest type being used throughout the machine. The collector rings are mounted outside the outboard bearing and are provided with a cast-aluminum drum with punched-metal covers

* Marine Engineer, Westinghouse Electric & Manufacturing Company.

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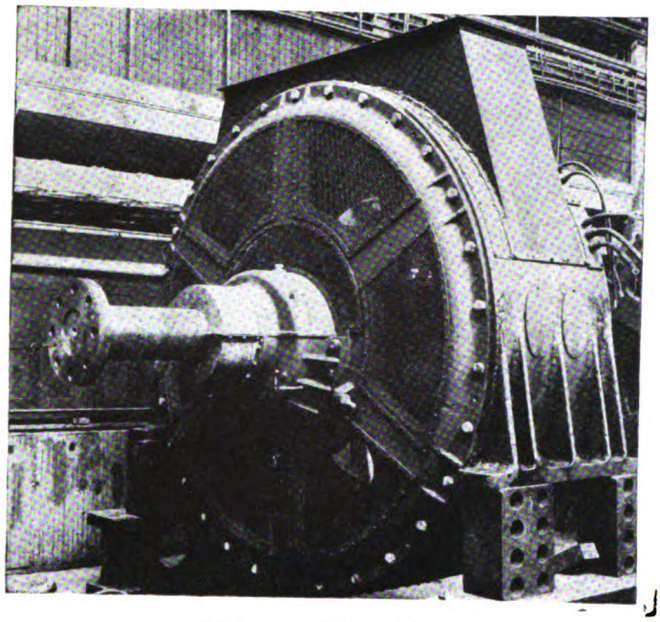


Main propelling motor

which are detachable, giving access to the brushes. The stator is arranged for radial ventilation. Fans sufficient for ventilation of the generator are mounted on the rotor. Cool air is brought from suitable ventilators on deck through ducts to air inlets in the bottom of the end bells at each end of the generator. The warm air discharges through the chimney at the top of the generator stator, thence through suitable ducts to the deck.

The main turbine is of the well-known Westinghouse combination impulse and reaction type, designed for operation at 250 pounds steam pressure, 250 degrees superheat and 28½ inches vacuum. The turbine itself has two bearings and is connected by means of a solid coupling to the main generator, which has one bearing. No bed plate is used under the turbo-generator set as it is mounted on a very rugged foundation built into the hull of the vessel. The impulse element of the main turbine carries two rows of moving blades and one row of stationary blades. The reaction element consists of 22 rows of moving blades and 22 rows of stationary blades.

In order to obtain the best possible steam economy four nozzle blocks are provided, each containing a number of nozzles. These nozzle blocks are used in pairs, one pair being used for slow speed and the other pair for high speed.

The main turbine has an impeller-type oil governor. The governor depends for its operation upon the variation in oil pressure produced by changes in speed of the impeller, which is mounted on the turbine rotor. This type of governor has proved very successful on a large number of marine installations. The turbine is also provided with an automatic stop governor, and an oil-operated, inverted-type throttle valve.

Method of Control

In the main control unit, a front view of which is illustrated on this page, the complete propulsion control outfit is built into a compact structure embodying an angle-iron framework with suitable mesh-type enclosing doors and steel panels on the front, on which are mounted the necessary instruments. At the center of the panel there are mounted three operating levers. By means of these levers, which are completely interlocked to prevent improper operation, all maneuvering, including speed changes, starting, stopping and backing, is performed.

Facing the front of the panel, the right-hand lever controls the directional switches, the left-hand lever controls the speed of the turbine and the center-lever controls the field switches, which control the excitation of both the motor and generator. Both the directional and field switches are of an air-break, cam-operated type built particularly for this service.

The turbine speed-lever operates an oil cylinder, which controls the oil pressure to the main turbine governor in such a way that the speed may be set at any value from 900 to 3600 on the main turbine by means of this lever, with the turbine still under the control of the governor. The turbine speed-lever provides 12 operating positions and a "secure" position.

The field lever has a "secure" and a "run" position with three intermediate "start" positions.

In starting up, or in maneuvering, the generator field is excited from the 240-volt bus, while the motor field is not excited but is connected to a field-discharge resistor. After the motor comes up to approximately synchronous speed as an induction machine, excitation is applied to the motor from the 240-volt bus and it pulls into step as a synchronous motor. The generator excitation is then reduced to normal by connecting the field to the 120-volt bus.

The directional lever has three positions, namely, "back," "off" and "ahead." The airbreak switches, which this lever operates, simply reverse two of the main cable connections to the propelling motor, thereby reversing the direction of rotation.

Interlocking System

Interlocks are provided in the control lever arrangement as follows:

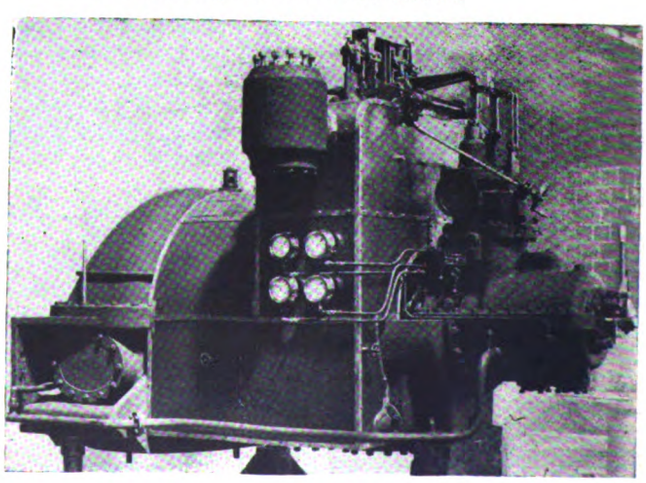
(a) The direction lever cannot be moved, regardless of setting, unless the field-switch lever is in the "secure" or first starting position.

(b) The field-switch lever cannot be moved beyond the first starting position, unless the direction lever is in the "ahead" or "back" position.

(c) The field-switch lever cannot be moved beyond the first starting position when starting unless the speed lever is in the 25 percent speed position; or, if running, it cannot be moved from the "run" position unless the speed lever is returned to the 25 percent speed position.

(d) The speed lever cannot be moved out of the 25 percent speed position, unless the field lever is in the "run" or "secure" position.

(e) Spring latches are provided on the speed-control lever and field-switch lever to prevent accidentally moving these to the "secure" position during maneuvers. These latches can, however, be manually released when desired.



The main turbine

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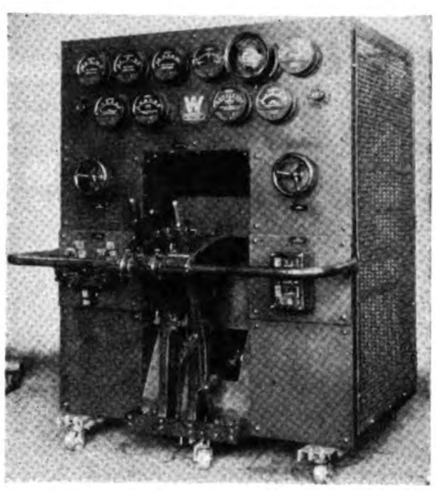
The steel panel at the top of the main control unit carries a main generator voltmeter, ammeter, wattmeter, field ammeter and stability indicator in addition to a temperature indicator for use with imbedded, temperature-detector resistors in the main generator and motor stator coil. There is also a ground detector, a main motor field ammeter and a speed indicator for both the propeller motor and the main turbine generator.

The main generator and motor field rheostat hand wheels are shown on either side of the operating levers. An arrangement is provided so that these rheostats may be clutched together for coupled operation. The lower panel carries a two-pole carbon circuit breaker with field-discharge contacts and shunt-trip arrangement. This breaker carries the field circuits of the main motor and generator and the shunt-trip attachment is operated only by the phase balance relay. This relay is mounted on the opposite side of the panel and operates only in case of an unbalance in the phases such as would be caused by a double ground. The doors at the rear of the control unit are interlocked with the field breaker so that the latter opens when the doors are opened, thus rendering all circuits in the control unit "dead."

The Auxiliary Power System

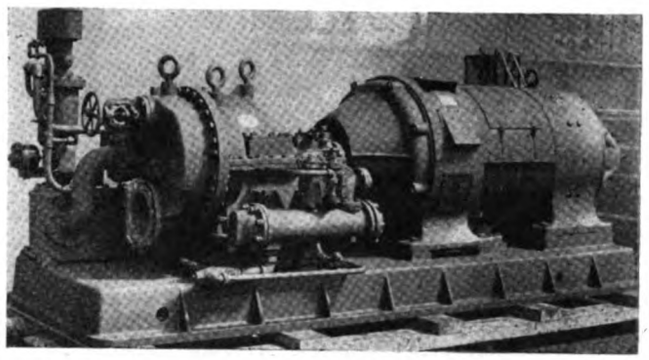
Illustrations are also shown of the two units of the auxiliary switchboard. This board comprises the control for the auxiliary generating units and the feeder switches to the various ship auxiliaries.



Main control

We now come to one of the most interesting features of this installation, involving the arrangement of the auxiliary power system. There are two so-called dual-drive auxiliary sets, each set consisting of a steam turbine, reduction gear unit, 100-kilowatt, 240 to 120-volt, 800 to 1200 revolutions per minute, direct-current generator, and a synchronous machine rated at 150 horsepower, 230 volts, 3-phase, 60-cycle. Each set is of sufficient capacity to furnish complete power, the other set being a spare. The auxiliary motors of the vessel are made of alternating current type wherever possible.

The alternating-current auxiliary load is divided into two groups, one classified as varying frequency, which group is normally connected to the main generator through a transformer and whose speed can vary without detriment to the operating characteristics in direct relation with that of the main turbine, and the other group comprising the greater portion of the auxiliary load, whose speed should be maintained practically constant, except for that difference, represented by the difference between full-load propeller revolutions and cruising propeller revolutions. A switch is provided so that the variable-frequency auxiliary bus may be connected to the constant-frequency bus, for use when starting up the plant.



Dual-drive unit, consisting of steam turbine, direct-current generator and synchronous motor

The transformer in this installation is rated at 250 kv-a. It takes power at 2300 volts from the main generator and supplies power at 230 volts to the variable-frequency group of auxiliaries, consisting of main motor ventilating-blower motor, main condenser circulating-pump motor, fuel-oil pump motor and to the alternating-current motor of the dual-drive set.

The constant-frequency group of auxiliaries includes the anchor windlass, the capstan, the forced-draft blowers, the general service pump motor, hull ventilation units, air compressors, machine shop, auxiliary condenser circulating-pump motor and laundry machinery. The 3-wire, 100-kilowatt direct-curent generator of the dual-drive set supplies direct-current power for excitation of the main units and of the alternating-current machine of the dual-drive set, as well as for the group of direct-current auxiliaries, consisting of fire-pump motor, sanitary-pump motors, refrigeration machines, radio, auxiliary condenser condensate-pump motor and the 120-volt direct-current lighting feeders.

When the vessel is running at any continuous speed between full speed and 2/3 speed, corresponding to 60 cycles and 40 cycles respectively on the main generator, one of the dual-drive sets will be operated, the synchronous motor of the set taking power from the main generator through the transformer and driving the direct-current generator, the set operating essentially as a motor-generator. Thus alternating-current auxiliary power is supplied direct from the main turbine generator in a manner similar to central-station power house practice, with the benefit of increased economy. The control arrangement of this dual-drive set is so arranged that as soon as the frequency of the main generator drops slightly below 40 cycles, steam is automatically turned on the turbine of the dual-drive set, after which the circuit breaker connecting the motor of the dual-drive set to the transformer is opened, with a result that the turbine drives the two electrical machines of the dual-drive set as generators, the alternating-current machine now operating as a generator supplying power to the constant-frequency auxiliary bus. The direct-current machine still furnishes excitation and direct-current auxiliary power. It is provided with a voltage regulator which maintains constant voltage over the speed range corresponding to the 40 to 60-cycle variation in frequency. Thus, when maneuvering the dual-drive set operates as a turbine generator set. As soon as conditions are again reached where the vessel will operate for some time at continuous speed within the 40 to 60-cycle range, the dual-drive set may again be easily synchronized with the main generator after which steam is automatically shut off the dual-drive set turbine. For port or emergency use there is an auxiliary Diesel gen-

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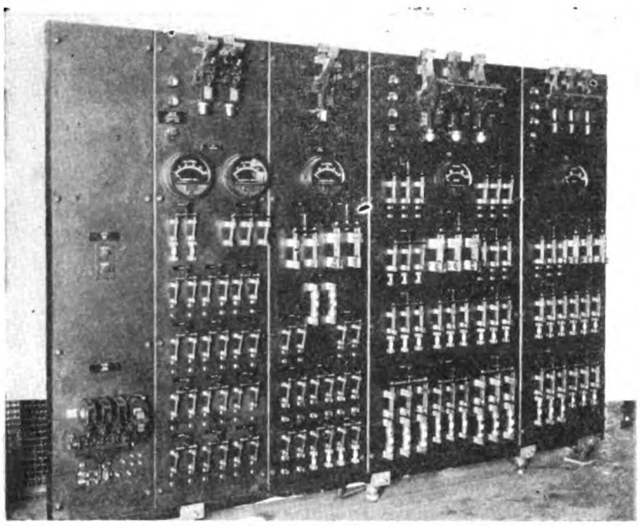

Auxiliary switchboard

erating set with a 50-kilowatt, direct-current generator and a 30-kilowatt, alternating-current generator.

It is believed that this novel arrangement of auxiliary system, enabling the use of the main turbine for furnishing complete power to the vessel with a very low water rate, will result in an extremely economical overall installation. Frequently, installations have been made where considerable effort and expense has been made to obtain a very economical propulsion plant with good success but where uneconomical auxiliary operation has largely defeated the gain in the propulsion end. The scheme as worked out for these cutters is, therefore, very attractive for general use, on a large number of ships.

The Bethlehem Shipbuilding Corporation is now completing the construction of these five cutters at its Fore River plant at Quincy, Mass. Complete propelling and auxiliary machinery was designed and built by the Westinghouse Electric & Manufacturing Company, the electrical equipment having been built at the East Pittsburgh plant and the steam machinery at the South Philadelphia Works of the company.

The Powdered-Coal Diesel Engine*

THE original idea of Rudolph Diesel was that of an engine which would burn powdered coal in accordance with the cycle which bears his name. At the time, this did not prove successful, and very shortly afterward the idea was abandoned. The German companies which took over the Diesel patents proceeded to develop an oil-burning engine and did it in a remarkably successful manner.

A few years ago, however, the idea was taken up again in Germany by several investigators. Of these, Pavlikowski was apparently the only one to achieve actual success. He found that a Diesel-type engine can actually run on powdered coal broken up to a fineness not exceeding that used in boiler firing, and that to all practical purposes any kind of coal can be used more or less successfully. As usual, many of the troubles anticipated in advance never occurred, and, for example, the wear on the cylinder and piston rings in the powdered-coal engine proved to be quite reasonable, and certainly not sufficient to place any obstacles in the way of commercial utilization of the engine.

It need hardly be said that a Diesel engine running on powdered coal, even with a lower efficiency than on oil, would prove to be of immense importance commercially. One thing that retards the adoption of Diesel engines for energy generation is the question of the cost of oil. Just now, we in the United States are passing through an era of low oil prices. Coincidentally, however, we are using up like spendthrifts the patrimony of ages, and burning up in a comparatively few years resources which, under proper management, should last the country for generations to come.

There is, therefore, a certain reluctance with regard to adopting a form of power generation, the economy of which is dependent on the price of oil. When it comes to coal, however, there can be no such reluctance. Our coal resources are so enormous that even if utilized at a rate several times greater than that of today they would still last for many scores, possibly hundreds, of years. The situation in the coal industry, moreover, is such that high prices need not be feared. In fact, the increasing mechanization of coal mines would lead one to believe that lower prices will come, combined with a higher standard of living of those employed in that industry. If powdered coal can be actually used in commercial Diesel engines, this will be a great boon to the manufacturer of such engines, who then will find a far greater market than that of today; to the coal industry, which at present is suffering from under-production not only in this country but in England as well; and finally and mostly to the public, which will obtain a new and convenient form of power generation and will not have to waste comparatively rare oil, but will rely instead on our plentiful abundance of coal.

* From *Mechanical Engineering*.

Speed Boats Made of Rubber Lumber Break Records

MOTORBOAT fans may wonder why Julius Herbst, of Wilmington, N. C., named his consistent winner of high honors, this season, the *Rubber Baby*. The name means just what it says—an infant boat made of rubber. There may or may not be speed virtue in the new rubber material with which the hulls of outboard motorboats are now being manufactured, but the fact remains that boats made of this material have been breaking world's records all through the summer and have been consistent winners at a number of nationally celebrated meets.

"Aeroboard," as the rubber material is named, is one of the latest of the thirty-odd thousand products made of rubber. It marks the invasion of rubber into the wood-products field. Aeroboard is rubber lumber and, according to its manufacturers, The B. F. Goodrich Rubber Company, Akron, O., it is not a substitute for the forest product but a lumber that has a number of advantages over the timber product. It is especially acclaimed in the manufacture of water craft because it is impervious to water, tougher than wood of the same dimensions and of equal tensile strength. Aeroboard has almost the identical elements of natural wood in its makeup. It is of a cellular nature and lends itself to the same methods of working that have made wood unique among construction materials almost since the beginning of time. Wood workers can saw it, plane it

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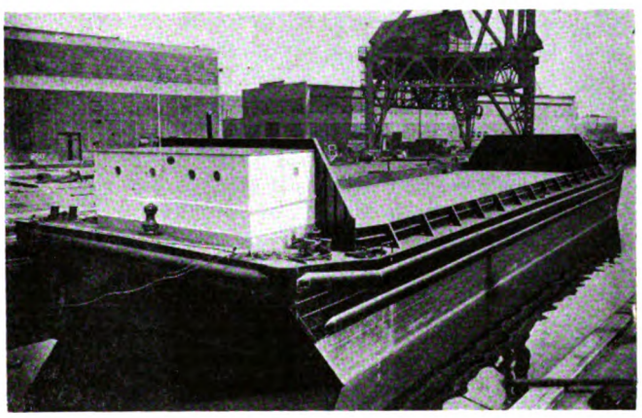
and apply to it all the workmanship that can be applied to wood. As material for speed boats, it has demonstrated its usefulness and advantages. Its greatest claim is that it will not absorb water. Mr. Herbst claims that the material used in his boats is a decided factor in his consistent winning during the season.

Federal Yard Builds All-Welded Barge

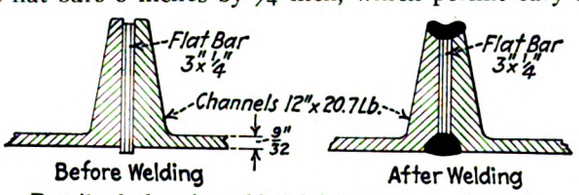
AS a result of experimental work in the application of welding to ship construction, the Federal Shipbuilding & Dry Dock Company, Kearny, N. J., has just completed an all-welded steel sand and gravel barge which will carry about 850 tons of



General view of all-welded barge

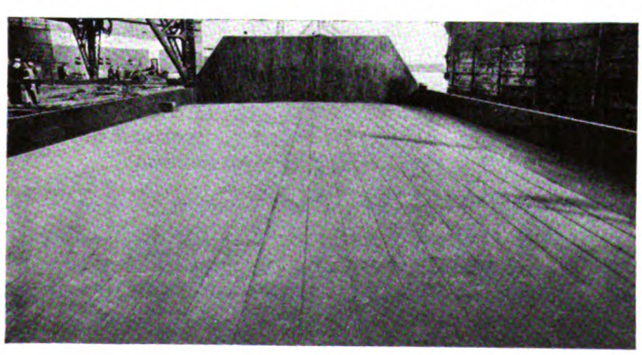
cargo. The barge is 116 feet long, 34 feet wide. 10 feet 3 inches deep and weighs 172 tons.

The hull is constructed on the channel system. Between the channels, which are 12 inches by 20.7 pounds, are flat bars 3 inches by ¼ inch, which permit easy re-

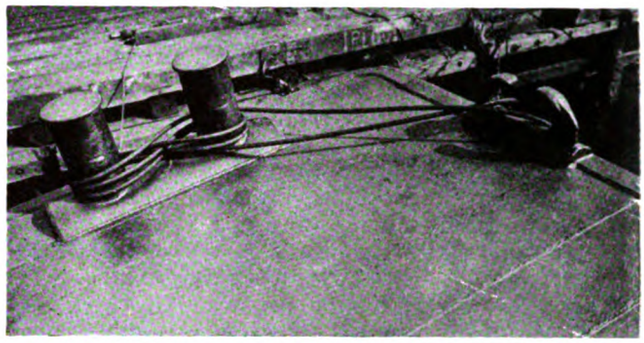


Detail of electric-welded joint between channels

moval and replacement of damaged sections of the channels. The thickness of the flat bar may be changed to suit variations found in the width of stock channels. As shown by the diagram, the channels are joined by a double seal of automatic electric welding. It is also of interest to note that the deck fittings, such as bitts and



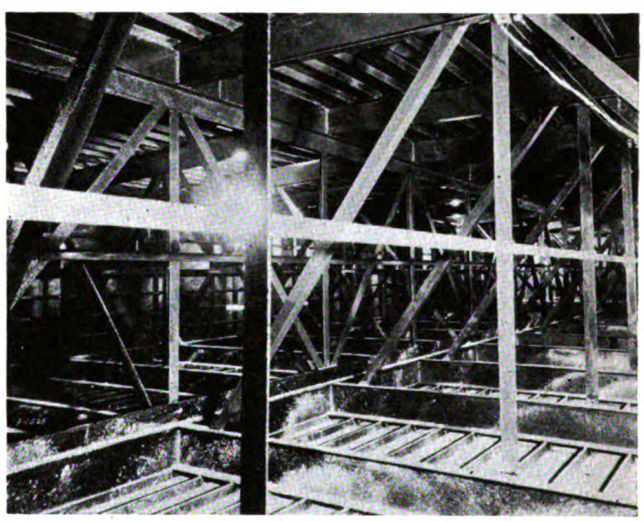
The welded deck of the barge presents a smooth surface



Deck fittings, made by welding together structural shapes, are welded to the deck

cleats, are made of structural shapes welded to the deck of the barge. The smoothness of the welded deck is particularly noticeable in the illustrations.

This design is applicable to scows, lighters, covered barges and tank barges. The Federal Shipbuilding Company believes that the change from wood to steel construction for such craft is inevitable on the grounds of lower average maintenance cost, lower insurance and increased carrying capacity, which remains constant throughout the life of the vessel. Welded steel construction offers the further advantages over riveted



View inside the barge, showing method of construction. Every joint in the vessel is welded

construction of lower first cost, tight joints without calking or packing and elimination of trouble from rivets due to damage or corrosion. The Federal yard has begun construction of an all-welded tank barge.

THE SHIPPING BOARD has instructed the Merchant Fleet Corporation to have three vessels in readiness to carry coal to the main Mediterranean ports at a minimum rate of $2.50 a ton, as the result of negotiations between the board and the Coal Exporters' Association. The vessels will be operated by the Export Steamship Corporation.

AMERICAN FLAG VESSELS in the seven months ended with July carried 34.5 percent, by value, of domestic exports and 32.4 percent of general imports, in the foreign trade of the United States, according to the monthly summary of foreign commerce issued by the Department of Commerce. In the corresponding period of 1927 the percentages were 35.6 and 34.9.

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Modern Marine Steam Generation

Recent developments in shore practice applied to marine watertube boiler design

THE efficient generation of steam depends upon several distinct operations each of which must be considered separately in design and then correctly combined with the others in order to produce a practical as well as an efficient steaming unit.

Until 1915 the generation of steam in large land plants and aboard ship had followed somewhat similar lines. Two hundred and fifty pounds was considered high pressure and super-heating had been given very little consideration. It is true that due to the necessity for large units the watertube boiler had become prominent ashore while the Scotch boiler was still the prevalent type used afloat, but in the Navy and in large passenger ships the watertube marine boiler had come into use with characteristics that followed land boilers except as restricted by space limitations on shipboard.

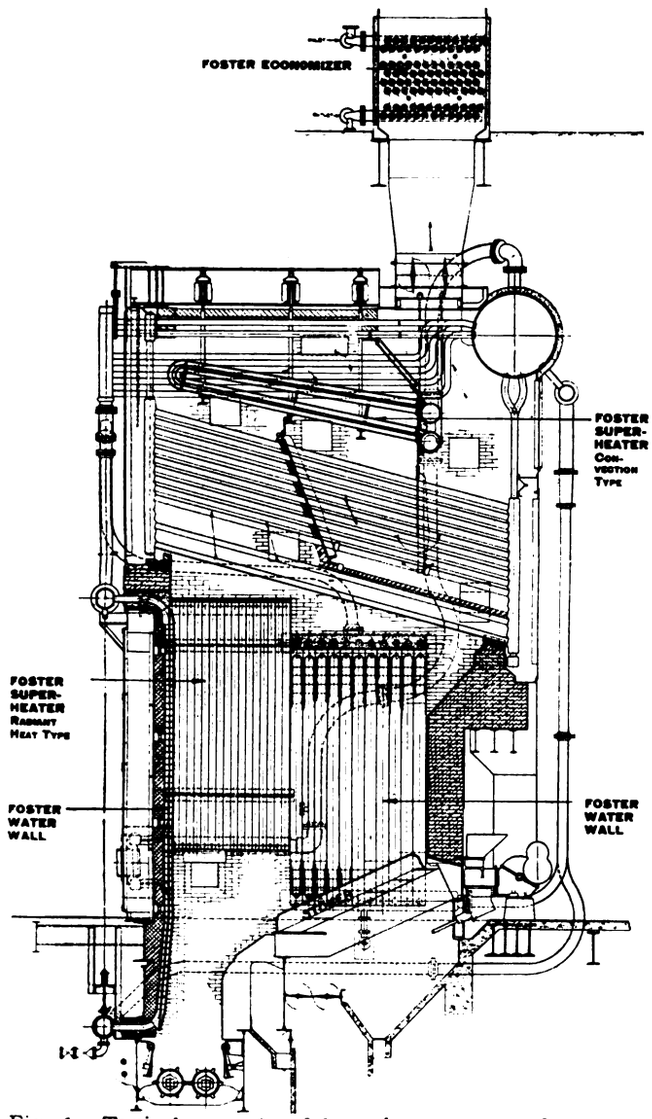

Fig. 1.—Typical example of large-furnace, cross-drum, sectional-header boiler as arranged for stoker-firing in stationary work

This is a 1276-horsepower Babcock & Wilcox boiler fitted with combination superheater, economizer and water walls. The furnace walls are thus steam or water cooled. The working pressure is 450 pounds per square inch

Due to the stagnation in shipbuilding, the development of marine boilers in this country has been slow since the war. On the other hand, the design of steam generators for land stations has progressed so rapidly that there are now few points of comparison with the stationary boilers of 15 years ago. The passage of the Jones-White bill has revived the interest in shipbuilding and the question naturally arises as to what extent marine steam generation can be improved through adapting the improvements established in land power plants.

The boiler, as we have commonly termed the apparatus used for steam generation, is composed of two parts having exactly opposite functions. The first is a furnace designed to withstand high temperatures and in which fuel is burned to produce heat. The second is a cooling furnace, which acts as a refrigerator in cooling the furnace and the hot gases of combustion. This is usually called boiler heating surface and it, in turn, has heretofore performed two entirely separate and distinct functions, namely: It first supplied the sensible heat necessary to raise the feed water to the temperature of evaporation and it then added the latent heat required for evaporation at the desired pressure.

In designing this boiler heating surface for marine use the following points are of major importance:

1. The form that the surface shall take.
2. The arrangement that will give largest steam capacity with minimum weight.
3. The absorption of the maximum amount of radiant heat by the water heating surface.
4. The largest possible water reserve.
5. The desirability of separating the surface used to supply sensible heat from that used to supply latent heat.
6. The precipitation of the scale forming solids present in feed water in a section of the boiler not exposed to intense heat.
7. Provision for rapid circulation over the hottest portions of the heating surface.

It is theoretically possible to design an ideal boiler, but can the requirements of efficiency be met with a construction that will be easy to repair, cheap to maintain and reliable under long voyages?

The tendency in modern steam generator design is to separate the total heating surface into the following divisions:

(1) Furnace walls and floor.
(2) Heating surface for adding sensible heat.
(3) Heating surface for adding latent heat.
(4) Heating surface for adding superheat.
(5) Heating surface for air preheating.

The Furnace

The furnace is now recognized as the most important part of the steam generator or boiler. The steam producing capacity is determined by the quantities of fuel which can be effectively burned in the furnace. The efficiency is also largely affected by the furnace as inef-

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ficient combustion will reduce the heat absorbed by the best design of heating surface.

It is very interesting to note the trend of furnace design ashore as illustrated in Figs. 1 and 2. It is at once obvious that furnace dimensions have been increased greatly and that the trend is toward complete water cooling of furnaces. Large furnace dimensions result in a relatively small B.t.u. release per cubic foot of furnace volume with attendant low furnace maintenance. Of equal importance is the efficient combustion of fuel and mixing of the gases before entering the water heating surface which results from the large furnace. It is well known that high boiler efficiency is dependent upon high CO_2 because of the smaller amount of excess air used. With small furnaces it is necessary to use more excess air in order to bring each particle of fuel into intimate contact with sufficient oxygen due to the shorter space of time available for combustion.

Water cooling of furnaces was at first used with the idea of decreasing brick work maintenance but the land engineer has since found that with it he is able to obtain higher efficiencies from less heating surface because of the large radiant heat absorption by such furnace walls. The application of complete water cooling will render the marine watertube furnace similar to the Scotch boiler furnace insofar as the elimination of brick work and other furnace troubles is concerned. Water walls replace furnace brick work, thereby reducing the area of incandescent radiating surface. Water walls lower furnace temperatures through the absorption of radiant heat and assist in the work formerly done by the lower rows of boiler tubes, thereby decreasing tube troubles. As space limitations aboard ship do not permit as large a furnace as is considered best practice ashore, the use of water walls is even more imperative in a marine furnace as they offset to a large extent this loss of furnace volume.

Addition of Sensible Heat

In the past it has been customary to heat the feed water to approximately 200 degrees by means of a feed-water heater and then depend upon the boiler to supply the remainder of the sensible heat in addition to the latent heat required to convert it to steam. Best efficiencies can be obtained by supplying practically all of this sensible heat before introducing the water to the evaporating section of the boiler.

There are two ways of obtaining this sensible heat. One is through the use of stage bleeding for feed-water heating and the other is by the combination of a low-pressure feed-water heater and an economizer recovering heat from boiler exit gases.

Table I was taken from data compiled by the U. S. Bureau of Mines. It shows the gas temperature drop through a straight-tube, cross-drum marine boiler. It establishes the fact that the last 40 percent of the boiler surface performs only 6 percent of the work and that the first 10 percent does 30 to 40 percent of the work.

Until recently this last 40 percent of relatively inefficient surface has been retained because it seemed the only practical means of reducing stack gases to a reasonable temperature. The present trend in shore and modern marine installations is toward the elimination of this last 40 percent of the boiler surface and the substitution therefore of a surface designed to effect efficient heat transfer from low-temperature gases. Contra-flow marine economizers have accomplished this very satisfactorily.

TABLE I.—TABULATIONS SHOWING PERCENTAGE OF HEAT ABSORPTION BY VARIOUS PORTIONS OF BOILER HEATING SURFACE *

Heating Surface passed over		Temperature		Steam Generated				
Sq. ft.	Percent	Total	Drop	Lbs. per hour	Total lbs.	Per-cent	Total Per-cent	Per sq. ft. per hr.
	0	2500						
305	10	1870	630	4880		32	32	16
610	20	1430	440	3050	7930	20	52	10
915	30	1140	290	2287	10217	15	67	7.5
1220	40	950	190	1678	11895	11	78	5.5
1525	50	810	140	1067	12962	7	85	3.5
1830	60	700	110	763	13725	5	90	2.5
2135	70	620	80	533	14258	3½	93½	1.75
2440	80	565	55	382	14640	2½	96	1.25
2745	90	525	40	305	14965	2	98	1.00
3050	100	500	25	305	15250	2	100	1.00

* These determinations were made by the U. S. Bureau of Mines on a 3050-square-foot Foster marine boiler.

On the other hand, stage-bleeding feed-heating must be considered, as the efficiency of steam turbines is increased by the use of such feed-water heaters; their application makes it possible to raise the feed temperature to 300 degrees or better. The employment of such equipment would partially eliminate the usefulness of the economizer as the sensible heat would be supplied by bled steam. In its place there would be a much smaller

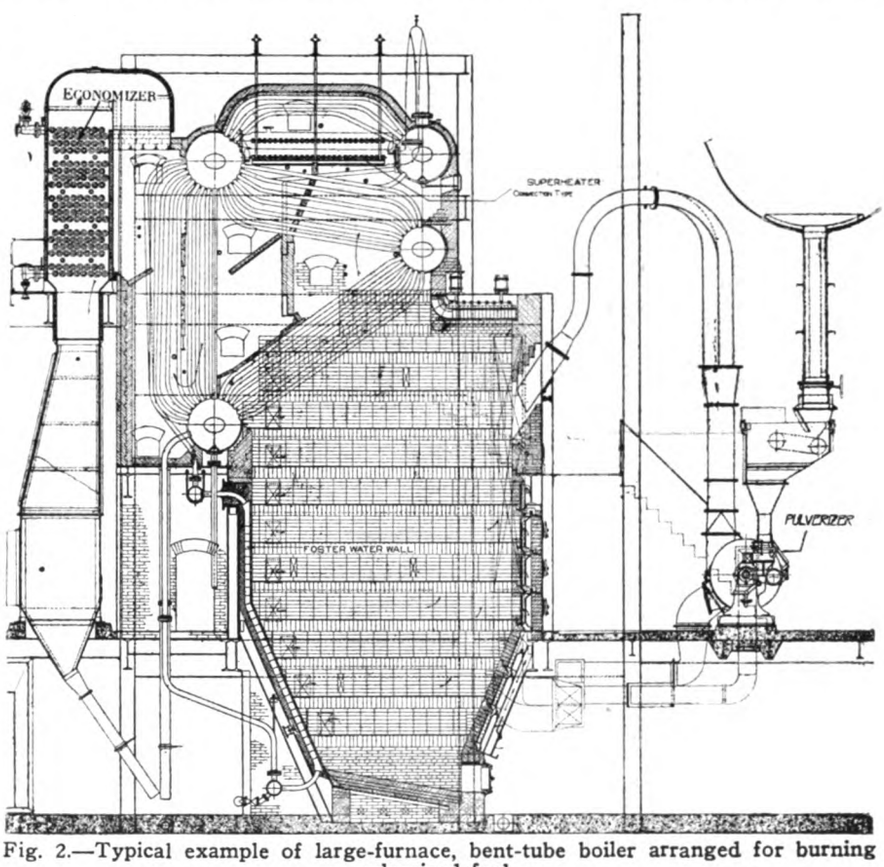

Fig. 2.—Typical example of large-furnace, bent-tube boiler arranged for burning pulverized fuel

This is a 1035-horsepower Kidwell boiler fired by an Aero-unit coal pulverizer and equipped with Foster superheater and economizer. The furnace is a combination of air-cooled refractory side walls and Foster water-cooled rear wall and hopper face. The working pressure is 250 pounds per square inch

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economizer and air heater or an air heater of great size (due to the comparatively low rate of heat transfer in an air heater), if the maximum efficiency is to be obtained. Such an air heater not only takes up excessive space, which can be used to better advantage in the furnace, but also requires the operation of both induced and forced draft fans. High-efficiency air-heaters are usually expensive to maintain due to corrosion from condensed stack-gas acids at the low temperature end. They also require large and costly air ducts from the air heater at the top of the boiler to the furnace at the bottom of the boiler. Ducts take up additional space, render portions of the boiler inaccessible and tend to make fire rooms much hotter.

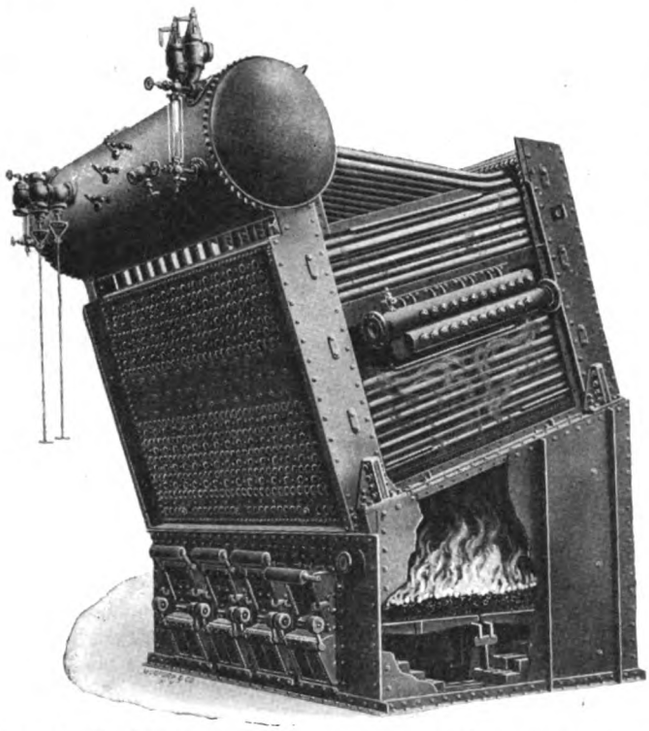

Fig. 3.—Typical example of cross-drum, straight-tube marine boiler as constructed during the war

This was regarded as a highly efficient boiler at that time but the restricted furnace is striking when compared with modern designs. The superheater and baffling are examples of the practice ten years ago

Troubles were also experienced through rapid stack-gas corrosion and internal oxidation of economizers in the early installations afloat and ashore. These difficulties have been overcome and there are now available reliable contra-flow marine economizers which will give satisfactory service. A study of the performance records, for many years, of a large number of economizer installations, now operating both in stationary and marine plants, will settle any doubt on this point.

The efficiency of an economizer has always been recognized and many simple devices have been tried in the past but failed because of the above-mentioned troubles. In the economizers now used external corrosion has been overcome by an extended cast-iron surface which is shrunk on to steel tubes. All exposed surfaces are of cast iron and all pressure surfaces are of steel tubing or forged-steel headers—an ideal combination for marine economizer service. Through the use of the extended heating surface it is possible to keep the area to carry the water small and the velocity of the water correspondingly high, thereby also eliminating internal oxidation.

The rugged and flexible construction of these marine economizers is shown in Fig. 4. The design is such that the water and gas pass on opposite sides of this surface in counter-current flow. This arrangement gives the most effective use of the heating surface thereby reducing weight and bulk. The contra-flow principle, so ideal for maximum heat transfer from lower temperature gases, is used in the economizers, but is impossible to obtain in the evaporating section. There are, at the present time, marine installations in operation in which economizers of similar type have been used and from which the exit-gas temperatures have been maintained in regular daily service well below 300 degrees while the feed-water temperature, leaving the economizer and entering the boiler, was considerably below 300 degrees.

The economizer effects the double advantage of preheating feed water to the required temperature and of reducing the higher boiler exit-gas temperatures. The relative cost of installation, space required and simplicity of operation favor the use of an economizer for high efficiencies as compared with an air heater. It would appear, therefore, that some combination of steam-bleeding heaters with economizers would present the ideal means of preheating the feed water and reducing boiler exit-gas temperatures.

Fig. 4.—View showing construction of marine economizer

The elements consist of straight steel tubes with hand-hole plugs opposite each end for easy cleaning. Upon the tubes are shrunk iron castings having gilled rings. The cast-iron rings present six times more heat absorbing surface to the gases per lineal foot than bare tubing. The ends of the elements are connected by forged-steel headers

Evaporating Surface

The evaporation section of the boiler or steam generator should be so designed as to present the maximum possible area to the radiant heat of the furnace. The circulation of water should be so arranged as to precipitate the scale-forming solids before the water enters the tubes exposed to the furnace. Tubes should be large enough for thorough mechanical cleaning. The general design should provide reliability, high capacity and means for making all repairs in the shortest possible time.

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One of the main advantages of the Scotch boiler over the watertube boiler in the past has been its greater water-storage capacity. In the design of a new boiler ample water reserve should be provided for.

Superheaters

Modern practice has demonstrated the important gains which result from high superheat and at the present time the only desirable limit to superheat is the temperature above which materials fail. To obtain this superheat it is essential to use heating surface of a design and material suitable to withstand the temperature to which it will be subjected. Supports should be arranged so as to prevent bending or warping of elements. The superheater should be so installed as to permit of successful and frequent external cleaning by steam jets. All joints and pipe connections to the superheater should be available from the fire room in order that it may be possible, in case of emergency at sea, to cut out individual elements with minimum delay and without cooling the boiler. This eliminates the necessity for by-passing the superheater, if a leak should develop—by-passing is undesirable as it may damage the entire superheater.

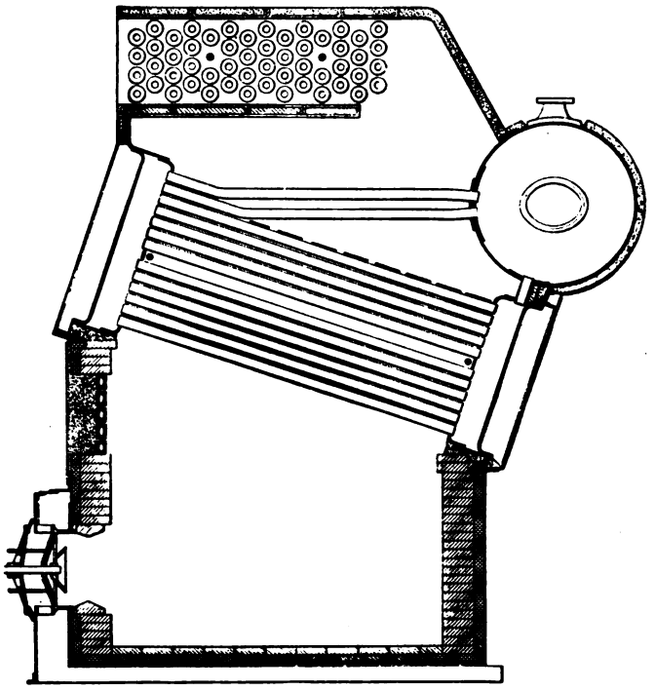

Fig. 5.—Cross-drum, straight-tube marine steam generator developed since the war

Notable improvements are the increase in size of furnace, radiant-heat superheater in the front wall above the burners, economizer at the top of the setting and minimum baffling for boiler tubes. The boiler tubes have a higher average effectiveness and the economizer insures the reduction of the stack temperature to the practical minimum

For certain fuels such as pulverized coal or coal fired by stoker, a certain amount of preheated air is generally advocated but there is a temperature beyond which the gain in efficiency from preheating air for combustion falls off rapidly. In using preheated air in a marine furnace care must be exercised, as marine furnace temperatures are already far in excess of what is considered best practice. Any material increase in the furnace temperatures will increase both furnace and boiler maintenance.

It appears that with present marine design the preheating of air approximately 100 degrees F. is all that is desirable for use with oil fuel and most pulverized coal or stoker-fired installations. This preheating will give most of the possible gain in combustion efficiency without approaching a point detrimental to furnace walls and tubes exposed to radiant heat.

Fig. 2 shows how these conditions have been met ashore. The boiler proper, which in the past was the greater portion of the total installation, has shrunk to relative small importance in the complete modern steam generator. The furnace occupies more space than the evaporating surface.

Development

The first move towards efficient marine steam generation, based upon the principals outlined, was the cross drum straight tube steam generator shown in Fig. 5. It has been installed in a number of steamers and is built in two types—a stay-bolted header for moderate pressures and a vertical wrought-steel sectional header for higher pressures. The furnaces are being fired by oil, coal hand-fired and by stokers.

The drawing shows a radiant heat superheater in the front furnace wall above the oil burners, this being the simplest form of marine superheater for this type of boiler, having all connections, handhole plates and headers outside of the boiler casing. This superheater has the advantage of giving practically constant superheat at all required ratings. It replaces a part of the brick work and cools the furnace by absorbing radiant heat.

Through the use of the economizer and radiant superheater it will be noted that it has been possible to obtain

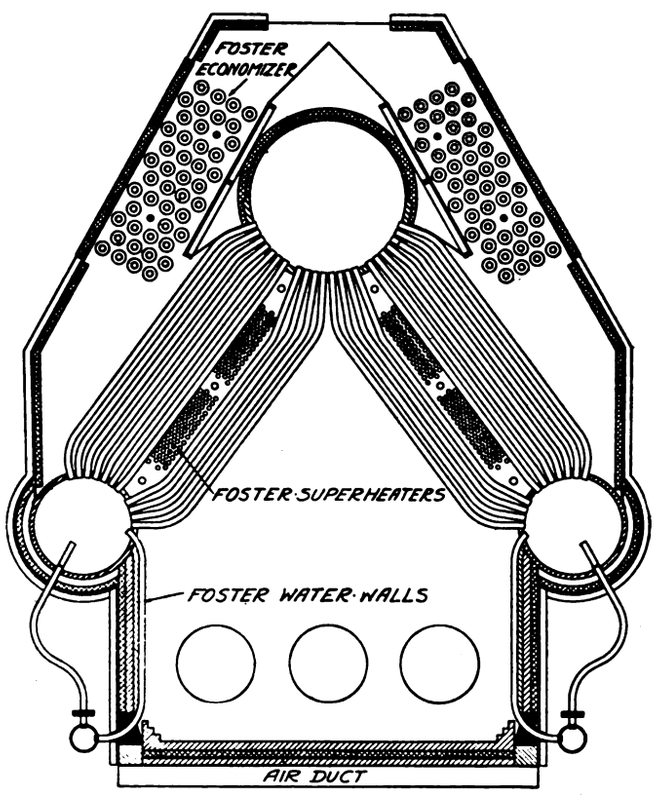

Fig. 6.—"A"-type of bent-tube marine steam generator

The drawing shows the economizer sections for adding sensible heat to the feed water, the evaporating sections for adding the latent heat necessary to produce steam, the superheating sections for raising the final temperature of the steam and the water-cooled furnace walls which permit liberation of heat at high rates per cubic foot of furnace volume without damage to furnace walls. The air duct under the furnace floor provides moderately preheated air and insures cool boiler supports

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a comparatively large furnace volume in the restricted head room available aboard ship.

Type "A" Bent-Tube Marine Steam Generator

An entirely different arrangement of boiler heating surfaces to give additional and better-formed furnace volume with more radiant-heat absorbing surface is given in Fig. 6. This shows the desirability of the bent-tube compared with the straight-tube, cross-drum boiler for marine work. The water reserve of this boiler is greater than that of the customary straight-tube, cross-drum marine boiler of the same heating surface.

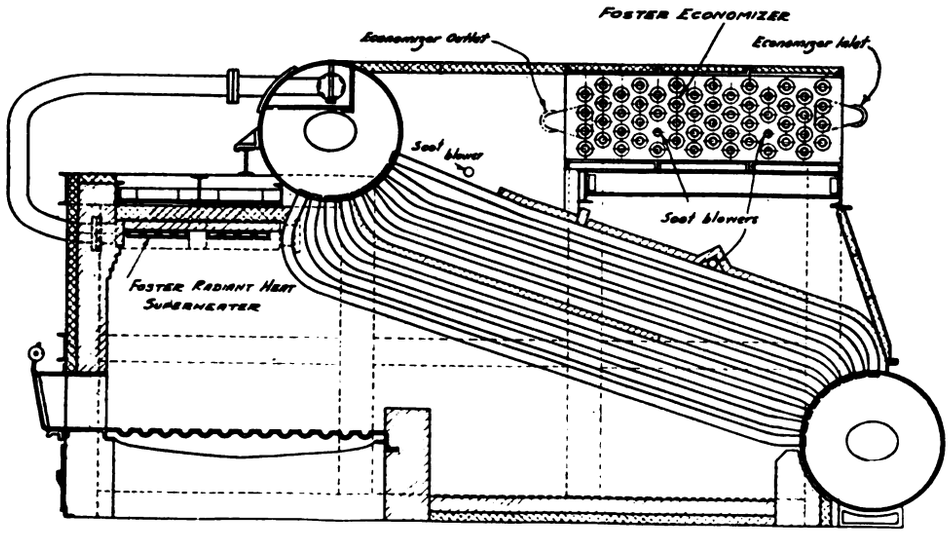

Fig. 7.—Two-drum, bent-tube marine steam generator of the Nelis type

This application of the principles involved in producing a modern steam generator is the result of working them into a very low headroom where ample fore and aft space is available. The results obtained in actual practice have been exceptionally satisfactory

The "A" type of boiler lends itself to water walls of simple construction and minimum cost. The water walls and inclined tube-banks present two large black surfaces opposed to the three radiating surfaces in the furnace. The rear wall can also be water-cooled, if desirable.

Economizer

The economizer sections are designed to raise the feed-water temperature from about 200 degrees to over 300 degrees, or close to the evaporation temperature. The economizer exit gases will be 300 degrees F. or less; a much lower temperature than that obtained on the marine boilers of the past except the marine steam generators above referred to (Fig. 5). The temperature of the water leaving the economizer is high enough to precipitate most of the solids in the economizer, where they will do the least damage and where they do not become as hard as in the hotter parts of the boiler.

Evaporating Surface

The evaporating surface of this "A" boiler is of a type familiar to marine men. It was developed principally for what is known as express service where extremely light weight with maximum possible steaming capacity and ruggedness were demanded. In the past this type of boiler has generally been built with small tubes which made internal cleaning very difficult. The arrangement of tubes made it necessary to replace numerous tubes whenever a tube in one of the inner banks had to be renewed. The use of the larger tubes, shown in Fig. 6, eliminates the cleaning difficulties and the tube spacing is arranged with alternate wide and narrow spaces permitting the removal of any tube with maximum ease and without removing any other. The replacement of boiler tubes with this arrangement will be much easier than in the cross-drum type of boiler, as anyone who has attempted to pull an encrusted tube through a tube sheet will know.

Circulation and Precipitation of Solids

The water of this boiler will pass down through the rear rows coming to rest temporarily in the lower drum before rising up through the furnace rows of tubes. The precipitation of any solids which have not been deposited in the economizer will take place, largely, in the rear rows of tubes and lower boiler drums. Solids which collect in the lower drums are prevented from entering the water-wall tubes by the long removable drum nipples.

The inclination of the tube bank permits of a much better and more rapid circulation of water, thus eliminating the frequent bowing of tubes which is experienced in the straight-tube, cross-drum boiler and which, no doubt, results from the pocketing of steam in the tubes at high capacities.

Cleaning

The cleaning of this boiler is simpler, quicker and easier than the cleaning of a straight-tube, cross-drum marine water-tube boiler, as removal and replacement of the large number of handhole plates is eliminated together with the attendant cleaning of gasket surfaces. In the three-drum, bent-tube boiler there are three hinged manhole covers to be swung in, after which the whole boiler is available for turbining of tubes. This ease of handling will permit of more satisfactory cleaning, resulting in a longer life of tubes and higher steam generating efficiency.

Superheaters

The superheaters in the "A" boiler are supported on special alloy steel brackets designed to withstand the temperatures to which they will be subjected and spaced at frequent intervals with a suitable attachment to the upper and lower drums. The arrangement of soot blowers shown will provide ample cleaning capacity. All superheater repairs can be made from the fire room without an operator entering the boiler casing.

Preheated Air

The air for combustion is preheated by drawing it

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down the back wall and under the floor. This provides about 100 degrees F. preheated air and cools these two brick surfaces thereby prolonging their life.

Space Required

The bent-tube steam generator will permit of the installation of more heating surface in a given space than any other type of boiler or steam generator. It would be possible with units of this new type to obtain sufficient steam for 100,000 shaft horsepower from eight steam generators which could readily be fitted into the space available aboard the average passenger ship. As an example, the S. S. *Leviathan* is fitted with 46 boilers of 4400 square feet of heating surface each. The design shown in Fig. 6, would occupy approximately one-quarter of the space of the *Leviathan* installation for the same amount of steam generated. This indicates the large saving in weight, space and cost of a modern steam generator as compared with previous boiler designs.

A further point in favor of the new steam-generating unit is the lower comparative radiation loss. With a steam generator having water walls as shown it is possible so to insulate the setting as to reduce the radiation, improve the economy and lower boiler room temperatures.

In some of the modern power plants ashore it is necessary to heat the fire rooms in winter to keep them at a temperature necessary for good working conditions.

The draft requirements of such a steam generator can be satisfactorily taken care of by the use of an induced-draft fan only, while any other arrangement for similar economy, using air preheaters in place of the economizers, would require the addition of a forced-draft fan.

Special Applications

Among the interesting applications of the modern principles in design is that given in Fig. 7, which shows a steam generator especially adapted to shallow-draft vessels where over-head space is unusually limited. The first installation of this type of steam generator has recently been completed and the initial trials have been highly successful.

Conclusion

There is a large shipbuilding program now under consideration. The new ships are to be built for greater speeds than those of the present fleet. The cost, size, weight and the commercial efficiency of the boiler room or steam-generating equipment will be an important factor in the contemplated vessels. Therefore, the new methods of steam generation—those that have been developed since the last shipbuilding era—are receiving the closest study of marine engineers. The principles here mentioned have been tried out in marine work for a number of years—long enough to show their true worth and importance in the building and operation of more profitable steamers.

Modern steam generators in conjunction with improved steam-using equipment will provide a reliable and efficient propelling plant, lower in both installation and operating costs than any other type of prime mover.

First British Turbo-Electric Liner Launched

LATE in September the first turbo-electric drive ship constructed in foreign yards was launched from the Linthouse Shipyard, Glasgow, Scotland, of Alexander Stephen & Sons, Ltd. This vessel, the *Viceroy of India,* was built for mail service of the Peninsula & Oriental Steam Navigation Company.

The *Viceroy of India* has a length of 610 feet; breadth, 80 feet; depth from upper deck, 82 feet; displacement, 25,000 tons; gross tonnage, 19,000. Accommodations are provided for 415 saloon passengers, each in a private stateroom, and 258 second-class passengers. The vessel is scheduled for delivery early in the coming year and will sail on her maiden voyage in February.

The turbo-electric propelling machinery of the *Viceroy of India,* which constitutes the principal feature of the vessel, was designed and supplied by the British Thompson-Houston Company, Ltd. of Rugby. The main plant consists of two B.T.H.-Curtis horizontal type steam turbines driving generators supplying current to two slow-speed, 3-phase, synchronous motors coupled to twin propeller shafts. The generator units

Turbo-electric passenger and cargo liner Viceroy of India after the launching

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which have a normal operating speed of 2700 revolutions per minute, are each capable of delivering 9000 kilowatts at this speed. The main propelling motors have a combined output of 17,000 shaft horsepower at 109 revolutions per minute. The vessel will have a normal service speed of 16½ knots and a maximum possible speed of 19 knots.

Boilers

The steam generating plant consists of six oil-fired watertube boilers supplied by Yarrow & Company, Ltd., of Glasgow. Four of these, located in the after smokehold, have an evaporative capacity of 30,000 pounds per hour and will supply steam at 400 pounds per square inch at a temperature of 750 degrees Fahrenheit. The four boilers have a combined heating surface of 6000 square feet, exclusive of superheating surface.

When the maximum speed of 19 knots is required, two smaller boilers similar in type, located in the forward stokehold, will be utilized. In addition, two cylindrical-type boilers are installed in the forward stokehold for supplying steam when the ship is in port. All boilers are equipped to burn oil on the Clyde system.

The generating equipment for auxiliary service includes four turbo-generator sets each with a capacity of 500 kilowatts direct current at 220 volts. These units were also supplied by the British Thompson-Houston Company, Ltd. In addition, Messrs. Petters, Ltd., of Yeovil furnished two 165-kilowatt oil-engine-driven generators for installation in the vessel.

Twin-Screw Diesel Yacht Vanda

Latest addition to pleasure fleet built by Bath Iron Works Corporation from Gielow designs

THE twin-screw Diesel yacht *Vanda,* which was built for Ernest B. Dane, of Brookline, Mass., was launched early in October at the Bath Iron Works Corporation shipyard, Bath, Me. This launching was unusual in that with the exception of a small amount of equipment and fittings the yacht was ready for sea.

The *Vanda,* which was built at an approximate cost of $750,000, was designed by Henry J. Gielow, Inc., naval architects, New York city, and constitutes a notable addition to the ever-growing fleet of modern Diesel yachts.

The main particulars of the *Vanda* are as follows:

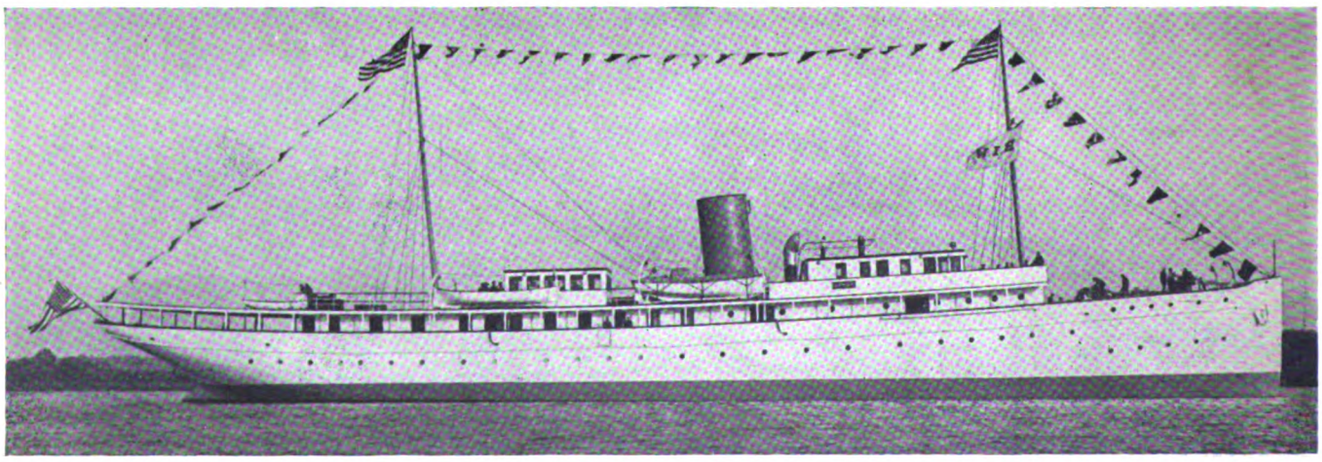
Length overall	240 feet 3 inches
Length on waterline	219 feet 9 inches
Beam	36 feet
Depth at main deck	22 feet
Depth at boat deck	30 feet
Draft, loaded	15 feet
Shaft horsepower	3,000
Speed, miles per hour	18
Cruising radius, miles	20,000

The *Vanda,* which is built to Lloyd's 100-A1 class, is of the straight stem, long overhanging stern, schooner-rigged design, the two masts, carrying staysails and mainsail. The hull is subdivided transversely by six watertight bulkheads extending to the weather deck and by four watertight and oiltight bulkheads extending to the lower deck. The latter bulkheads, together with watertight flats in conjunction with them, form deep tanks for fresh water and for fuel-oil storage. Where the hull is not protected by the deep tanks, a double bottom is provided. In all, the hull is divided into 25 oil and watertight spaces. The tanks have a capacity of 160 tons of fresh water and 347 tons of fuel oil.

The entire superstructure and deck houses are of steel, while the main deck and boat deck are planked with teakwood.

Machinery Details

The propelling machinery consists of two 4-cycle, solid-injection full-Diesel engines developing 1500 shaft horsepower each, built by the Bessemer Gas Engine Company, Grove City, Pa. The cylinder dimensions for these engines are diameter 18 inches and stroke



The Vanda immediately after the launching

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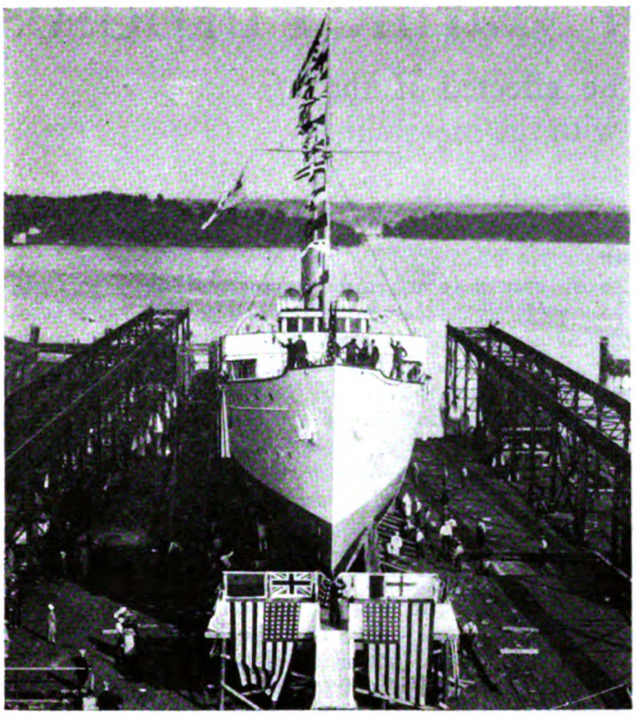

View of the Vanda on the ways at the Bath Iron Works

22 inches. The engines are connected to separate bronze propellers made by the Hyde Windlass Company, Bath, Me., turning at 300 revolutions per minute. The designed speed of the *Vanda* is 18 miles per hour with a sailing radius of 7500 miles at full speed or 20,000 miles at cruising speed.

The auxiliary equipment includes two Bessemer Diesel engine-driven generators, each having a capacity of 60 kilowatts. The usual complement of pumps for a ship of this class is installed, all of the pumps being motor driven. The pumps are used for circulating water and oil for the main engines, cold, salt and fresh water and hot water for sanitary and culinary purposes, and bilge and fire service. The auxiliaries also include air compressors, oil purifiers, hydro-electric steering gear, and the like. A complete fresh-water distilling plant is installed. The vessel is heated by steam generated in a small steel boiler equipped with oil burners. The vessel is also equipped with the Thermofan system of heating and ventilating supplied by the Schutte & Koerting Company of Philadelphia, Pa. A 4-ton ice machine provides refrigeration for the cold-storage rooms, the galley and pantry.

The deck machinery is electrically operated and consists of an anchor windlass, double boat hoists and a warping capstan. All this equipment was supplied by the Hyde Windlass Company. The yacht is equipped with a radio direction finder, electric log, pneumercator gages for all tanks and draft gages which can be read in the chart room.

Accommodations

On the starboard side of the main deck amidships is located the lobby, which is paneled in walnut. Immediately forward of this is the combined living and dining room, which is 34 feet long by 27 feet wide. On the port side from this space is the owner's suite consisting of a sitting room, dressing room, wardrobes, a large bedroom and a bath. Access to the owner's suite is also provided from the after deck through a vestibule and by means of a stairway from the boat deck.

The dining and living room is paneled in American black walnut. At the forward end of the dining room on the starboard side a door opens to a long passageway leading to the smoking room. This passage and smoking room are finished in fumed oak in small panels. The floors of the entrance lobby and passage are covered with rubber tile while the other rooms are heavily carpeted. The pantry and galley are located on the port side forward of the dining room.

From the entrance lobby two stairways lead to the lower or cabin deck. Two bedrooms located on the forward side of a steel watertight bulkhead are reached by one of the stairways. One of these rooms is 22 feet long by 15 feet wide while the other is 18 feet by 15 feet. Separate bathrooms and wardrobes are provided for each stateroom. Aft of the watertight bulkhead are located the remaining guest rooms, the maid's room, linen room and trunk room. The main guest suite is also located here, which consists of a bedroom, 16 feet by 13 feet, a bathroom and sitting room.

The deck officers' quarters are located on the boat deck, while the chief engineer's are on the lower deck forward of the engine room space. The officers' mess room and bathroom are also located on the lower deck, while the petty officers' quarters are located in the forecastle with crew quarters under on the lower deck.

High-Pressure Steam Generators in British Vessel

By G. P. Blackall

A VALUABLE comparison of alternative methods of high-pressure steam generation is provided by the arrangements employed in the recently launched Pacific and Orient liner *Viceroy of India,* which will be fitted with turbo-electric machinery, and the Canadian Pacific liners of the *Duchess* class, which have single-reduction-geared turbines. These vessels have the same working steam pressure of 350 pounds per square inch, superheated to 700 degrees Fahrenheit, and each has a boiler installation of six Yarrow small-tube type watertube boilers.

The Canadian Pacific liners, in addition to the watertube boilers, are each fitted with two cylindrical boilers, of the multitubular type, having a working pressure of 250 pounds per square inch, to which all the feed make-up water is introduced and thence led to the turbines as intermediate-pressure steam at the appropriate turbine stage. This system eliminates the possibility of injury to the watertube boilers from impurities.

The Ellerman liner *City of Roubaix,* which is fitted with high-pressure geared turbines, is equipped with ordinary cylindrical-type marine boilers, operating at a working pressure of 300 pounds per square inch. This pressure seems to be the upper limit, practicable with boilers of this type.

From the foregoing, it will be seen that in the high-pressure marine steam installations, so far developed for British ships, widely differing arrangements have been employed. A still further difference will be introduced in the high-pressure turbine installation to be fitted in the Holland-America liner *Statendam,* which will be fitted with Babcock & Wilcox large-type watertube boilers, having a working pressure of 400 pounds per square inch.

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Steam Machinery for Marine Purposes

Economies that must be effected if the steamship is to compete with the motorship

By Captain H. C. Dinger, U. S. N.

THE advent of the oil engine and its superior economy in numerous marine installations is forcing designers of steam machinery to secure more nearly the ultimate economy possible. In shore practice the relative cheapness of coal and the fact that the steam engineers have secured material reductions in fuel consumption has not permitted the oil engine to usurp such a commanding position. There are certain shore steam plants which have a thermal efficiency that is not far from that of the oil engine, while, on the score of overall expense, steam and coal are still supreme for large power plants throughout most of this country.

If steam is to survive in marine work, it must take advantage of certain possibilities and secure a measure of economy considerably in advance of what now is obtained. In shore practice some plants obtain a kilowatt on 12,000 B.t.u. or a horsepower on 9000 B.t.u. The best marine practice gives about 15,000 B.t.u. per horsepower while the average is well over 20,000.

Can some of this margin be reduced in marine practice? At least one-half of it can be by adopting certain devices which secure economy in shore practice and adapting them to marine work. Some of these are:

- Higher pressure
- Superheat
- Stage heating and bleeding
- Improved auxiliaries and auxiliary drive
- Better turbines
- Better condensers
- Better heat insulation
- Boiler improvement
- Reheating
- Deaerating
- Designing for avoidance of corrosion and corrosion fatigue.

However, while the shipbuilder is desirous of having an economy of 0.55 pound of oil per horsepower, he also is specially interested in securing an installation that is entirely reliable in operation, durable and with low operating and repair costs. In fact these latter points are perhaps more pertinent than the better economy. Hence the future hope of the marine steam installation must take these points into special consideration in its design. This can be done, if in the original plan of cost, weight and space, we are willing to make the necessary allowance to secure those things which will give greater reliability, durability and freedom from corrosion. There are certain refinements in the use of more careful design and a more discerning selection of special and noncorrodable materials, and in the provision for auxiliary apparatus that will guard against deterioration. These will serve to reduce the cost of operation very materially, although first costs may be somewhat higher.

Initial Temperature and Pressure

Many shore stations, particularly where coal is relatively cheap and where power factors are high, are going to high pressures, but the majority of the very large stations recently placed in operation do not go beyond the limits of 400 pounds and 725 degrees F. temperature. Numerous plants having considerable higher pressures are of course in operation and apparently successful. On vessels where the power factor is rather variable and the investment charge very heavy, it does not appear advisable to go beyond the above figures on the basis of securing the best returns for the investment.

Messrs. Mellanby and Kerr, in a paper before the North East Coast Shipbuilders, came to the conclusion that the greatest economy to be derived from a steam plant using 1000 pounds pressure, 900 degrees F. superheat, two reheats and eight stage heaters would be 0.37 pound of oil per shaft horsepower. With 350 pounds, 600 degrees F. superheat, no reheat, three-stage heating, with economizers or feed heaters to secure a boiler efficiency of 90 percent, there is a theoretical possibility of securing about 0.45 pound of oil per shaft horsepower, while the figure of about 0.55 is something that might be actually guaranteed by a thoroughly efficient design. Sir Chas. Parsons in his recent paper gives 0.62 pound of oil per shaft horsepower as a figure that can be secured with 500 pounds, and 750 degrees F. temperature and 85 percent boiler efficiency. None of our actual marine installations has as yet approached these figures except for the *King George V*. The best are about 0.80 pound of oil per shaft horsepower, with somewhat less pressure and superheat; but also without taking full advantage of stage-heating, boiler economy or certain other refinements in design.

What is the best pressure and superheat to use in a marine installation? Three hundred and fifty pounds and 550 degrees F. are the highest employed except for the *King George V*, which is admittedly experimental. The gain due to the use of superheat higher than 550 degrees is a material gain, but with temperatures higher than 550 degrees special material is advisable, if not definitely essential, to secure reasonable durability. The expansion in the piping is difficult to allow for; heat insulation and ventilation become more serious problems. The operation of the auxiliaries and the control of superheat at varying powers present rather interesting and somewhat embarrassing difficulties. If we go above 600 degrees F., we are likely to see deterioration of superheaters on board ship, if ordinary steel is used. All these matters are pertinent from a practical view point, and it is doubtful whether the little gain in economy will compensate for the difficulty and expense that superheat greater than 600 degrees F. would produce.

A pressure of 350 pounds does not require any abnormal change from present average practice as to materials, while the overall practical gain by use of higher pressure is so small that the extra expense in capital charge would practically offset the gain in fuel economy under average conditions of operation. Certain calculations made on a cost basis for power-house practice have indicated that the most economical pressure is about 400 pounds. Investigators both in this country and in England have reached this conclusion. For ships, it certainly would hardly be higher than this. An examination of all data available would lead one to think that 350

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pounds pressure is about the highest pressure to use on the basis of earning power for marine work. Somewhat higher pressures will, of course, show a decrease in fuel consumption, but what the shipowner is interested in is operating profit and after reaching 350 pounds the financial gain due to higher pressures on marine jobs is more or less fanciful. If ships were steaming every day of the year instead of only about 50 percent of the time, this situation might be changed a bit. High-pressure plants on shore are being applied only where continuous operation at approximately full power is in vogue, or where the high-pressure steam, after being passed through the high-pressure turbine, is utilized in existing moderate-pressure turbines. Under such conditions very small savings in fuel become a matter of considerable magnitude in consideration of capital charges.

Stage Heating

This is by far the most favorable field for securing increased economy. Now single-stage heating from auxiliary exhaust is employed. Also an auxiliary condenser is in operation and the heat going to it is rejected to the sea water. It would be comparatively simple to devise a stageheating system in which what is now the auxiliary condenser would be the first-stage feed-heater, the feed tank a second-stage and deaerating heater, fed by the auxiliary exhaust, and a third high-pressure heater fed by bled steam from one of the stages of the main turbine. On passenger vessels where there is a larger portion of auxiliary exhaust this auxiliary exhaust might be divided up between two heaters in series so that there might be a fourth-stage arrangement. On most merchant vessels the auxiliary exhaust would be insufficient to heat the feed above 200 degrees F., so this could be amplified by bled steam to about 300 degrees F. or more. A well-designed three, or four-stage heating-system would reduce the fuel consumption 8 to 10 percent and it would fit in very well with an arrangement for deaerating the feed water. The stage heaters would not add much weight since the first ones in series would be of the low-pressure type and could be of fairly light weight.

Stage heating is closely associated with the matter of type of auxiliary drive and deaeration or treatment of feed water. These matters should all be considered together and should be harmonized and adjusted to each other. If this is carefully done, fairly simple installations can be obtained which will secure practically all the economy possible and yet not add very much to the first cost.

Turbines

There appears to be but little field for improvement in the economical design of turbine units. Double-reduction gears accomplish something at the expense of weight and space. Better design of exhaust connections, so as to reduce the leaving loss, also would give some improvement. Properly designed reduction gears are more economical than electric-drive systems, except when operating at small percentages of full power. The electric drive is more expensive, is heavier and occupies more space. Bleeding steam from main turbines for heating feed water will tend to give a little better condition for the low-pressure end, which is extremely desirable. It would appear advisable to make arrangements particularly where higher pressures are used, so that turbines are divided into three stages separately geared to the shaft so that the high pressure might operate at 3000 to 3500 revolutions per minute, while the low pressure could be reduced to about 2000 revolutions per minute. This would give better practical operating conditions for both high-pressure and low-pressure ends.

Improvement, however, can be secured in durability by using a better design of blading and by adopting the most desirable materials. For low-pressure turbines, reaction blading of non-ferrous composition, as used in Parsons turbines, appears to be the most advisable from the standpoint of durability and reliability. For the high-pressure turbines, impulse blading of stainless (chrome) steels or of monel metal are preferred. Nozzles should be made of stainless steels, as these seem to resist erosion better than any other material yet tried. Some improvement appears possible in the design of the steam glands, so as to reduce steam losses and avoid contamination of the lubricating oil. In all high-speed turbines careful balancing is most essential. The use of high-grade blading materials, capable of resisting corrosion fatigue, symmetrical design and careful balancing, will enable higher rotative speeds to be used for the high-pressure part. This, in turn, will tend to compactness and lightness, as well as in the reduction of areas subjected to high temperatures, which will reduce radiation losses and the problem of engine-room ventilation.

Condensers

Two things are pertinent in a marine condenser. Prevention of salt leakage and obtaining a good vacuum. Of these the former gives the operators more concern, and its effect is also very insidious in causing deterioration. The following are some measures which may tend to guard against salt leakage:

(a) Using single-pass condensers with scoops for vessels having a speed of 15 knots or more.
(b) Use of expanded tubes in lieu of packed tubes.
(c) Use of most suitable tube material.

Admiralty metal appears at present to have the best weight of authority and experience behind it. Red brass is being considered as being less corrosive, while Muntz metal has been found to be less satisfactory than Admiralty metal.

Monel metal or other special copper-nickel alloy tubes have been used in a few installations and promise to be more lasting than Admiralty metal, but are also likely to be more expensive. Nickel and stainless (high chromium) steel are also being experimented with, but these are also likely to be expensive and the heat-transfer qualities are not as good as brass.

A marked improvement can be made by having condensers under the low pressure turbine, or so that the exhaust comes from the lower half of the turbine. Considerable improvement can be made in marine condensers in providing (1) more open access of the exhaust to the cooling surface; (2) in making provision for the vapor to distribute itself longitudinally to allow for the increase in water temperature from inlet to outlet; (3) providing suitably designed means for air separation and cooling without air blanketing tubes or too low condensate temperature; (4) making proper provisions for keeping condensate from dripping over lower rows of tubes or into air spaces, thus tending to have the air going to the dry suction as dry as possible.

Type of Drive for Auxiliary Engines

This matter has received considerable discussion of late and theoretically it would be more economical to use all electric auxiliaries. There are, however, certain practical objections to this. We are not yet very favorably inclined to electric forced-draft blowers or all electric feed pumps and there have to be some steam auxiliaries in any case. So the practical result is that there will be a compromise and a combination of electric and steam auxiliaries. Hence, the electric auxiliaries should be used where they fit in best; that is, for those located

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outside of machinery spaces or where the service is quite intermittent. Steam-driven auxiliaries should be used in the machinery spaces for blowers, pumps, etc., where the steam drive has certain operating advantages and is cheaper. The exhaust from these steam-driven auxiliaries can be used in the stage-heating system and would, in most installations, have to be supplemented by steam bled from the main turbines. Care should be exercised that the auxiliary steam engines are not wasteful and considerable steam can be saved by having several pumps driven by the same turbine. Economy also can be secured by having special nozzles for operation at low powers and by employing high-speed turbines and reduction gears.

The electric generators can, of course, be driven either by a steam turbine or by an oil engine, the oil-engine drive being, of course, much more economical, but also more expensive in first cost.

Sir Charles Parsons, in a recent paper, has furnished estimated data as to overall fuel consumption with various types of drive for auxiliaries and the most efficient machinery that might be applied under initial pressure 500 pounds, initial temperature 750 degrees F., vacuum 29 inches, B.t.u. oil 18,500, boiler efficiency 84 percent, feed temperature 310 degrees F.

	Oil per shaft horsepower
A. With steam-driven auxiliaries	0.655
B. Steam-electric auxiliaries	0.648
C. Diesel-electric auxiliaries	0.62

If the practical combination of steam-driven and electric (from oil generator) is used, the figure will be about 0.637, which is but slightly below that for Diesel-electric, the cost of which would be considerably more.

Heat Insulation

One of the lesser undeveloped fields for securing extra economy, without increase in operating expense, lies in the intelligent application of proper heat insulation. If we go to higher temperatures, more attention must be paid to this. If the insulation is applied properly where needed, heat losses can be avoided and the machinery spaces made comfortable.

The type of insulation must be suited to the temperatures incurred and the insulation must be properly applied, not put on haphazard. A little more attention paid to heat insulation can easily reduce the fuel consumption by several percent.

Boiler Improvement

If we go to higher pressures, it will be necessary to adopt some form of economizer or air heater or else lose a few percent of boiler efficiency. Air heaters are more bulky but can be fitted in quite well with coal-burning watertube boilers. Air-heating arrangements do not work in so well with oil-burning boilers. So it seems that with oil-burning boilers or where space is not available, economizers would be added to the boilers; while the coal-burning boilers, air heaters would be installed. Both of these devices can now be properly guarded from deterioration and hence there is no necessary concession to reliability by their installation.

The higher pressures will call for watertube boilers. Where weight and space are available, the large straight-tube boiler would probably be used, but where lightness and compactness are matters of importance a bent-tube express boiler would find a place. In order to secure more compact boilers and a more effective utilization of heating surface, boiler design should be modified in the direction of securing a large proportion of heating surface, boiler design should be modified in the direction of securing a large proportion of heating surface exposed to radiant heat. By doing this the performance per unit of heating surface may be increased considerably.

Reheating

Reheating has proven successful in several power plants where the steam is taken back to specially equipped boilers for resuperheating and then brought back to the low-pressure turbine. This particular method of reheating it not well adapted for use on board ship but another method, where the partially expanded steam is reheated at the turbine by means of superheated steam from the main steam pipe on the engine side of the throttle, has more favorable possibilities on high-powered vessels, particularly where conditions are such that maximum power is not constantly maintained. The actual gain from such a reheater, like the first 60 degrees of superheat, is likely to show an economy greater than that theoretically accounted for, because it drys the steam puts it into better condition for doing its work efficiently. Wet steam is much more prevalent and its deteriorating effect upon efficiency much more marked in marine turbines than on land turbines; hence, any device that in any way tends to eliminate this trouble should be given most favorable consideration by the designers of marine turbines.

Deaerating

The details of deaerating devices will not be covered here, but it suffices to say that deaerating apparatus that will eliminate practically all the air out of the condensate can be installed in conjunction with a stage feed-heating apparatus which adds but little weight and requires but little additional space.

The effect of deaeration is extensive. The main purpose is to eliminate the air from the feed water so as to avoid oxygen corrosion in superheaters, economizers, boilers and piping. Without proper deaeration these parts are subjected to corrosive action and hence economizers are not fitted and high-temperature superheat is viewed with alarm. Superheated steam above 700 degrees F. in the presence of oxygen attacks steel. If the oxygen is eliminated, this action is guarded against. If oxygen is eliminated, feed-water treatment will guard against boiler corrosion, but no feed-water treatment can effectively guard against certain corrosion due to the presence of the dissolved air in feed water.

Air-free steam is also exceedingly desirable. It will tend to avoid priming and to securing dry and clean steam. The parasitic action and thermodynamic loss, due to the presence of the air in the cycle is avoided. Air-free exhaust will give a considerably better condenser performance and, if we have air-free steam, the air-ejecting apparatus will have less load and a better average vacuum will be secured. Air-free steam and feed will materially lessen the corrosion in piping.

These are no mere laboratory theories but actual practical facts that every marine steam power plant has to contend with. The deleterious effects of air in the system are not properly appreciated and until recently the means for eliminating the air were not well developed. Our knowledge of this matter has been much advanced by development in large high-pressure power plants, and marine engineering should not be lagging in adopting proper air-eliminating apparatus because the adverse effect of air in the steam system is comparatively greater from the economic and financial point of view than it is on shore.

It costs more to retube boilers, economizers, etc., on ship than on shore and when a ship is laid up for repairs

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it earns no money. Until now corrosion of marine boilers has been guarded against by keeping down salt leakage and treating boiler water with certain boiler compounds, whose principal ingredient is soda. While this was good as far as it went, it did not guard against the corrosion due to the dissolved oxygen in the feed. The deaerator eliminates this oxygen and hence complements the other feed-water treatment so that with a deaerator and proper use of an efficient boiler compound, corrosion on water sides of boilers, economizers, etc., should be definitely prevented.

Some years ago salt water was freely used in marine boilers. It has taken many years to get away from this and to use fresh water. Air elimination will very likely go through a similar experience. It is much cheaper and better not to use salt feed; so also it is cheaper and better to have air-free condensate and steam. The evaporator did for salt feed what the deaerator will do for air-infected feed.

Welding

Very considerable reduction in cost and saving of weight, as well as some increase in efficiency, may be secured by the more extensive use of welding in piping and machinery.

The use of welding lessens the number of joints, thereby reducing leakage. It permits of insulating material being applied in a much more thorough and effective manner and enables reliable steel plate materials to be used in place of more or less unreliable steel and iron castings.

Welding will find possible applications in the following:

In piping for connecting sections, building up of fittings and for welding flanges to piping where flanged joints are required for removability.

For building up of condenser, feed-heater and evaporator shells and for tanks of various kinds.

For boiler casings and uptakes, exhaust pipes and trunks, ducts, etc.

For building up of turbine casings, gear casings, foundation structures, etc.

In attaching boiler fittings and connections, reinforcements and connecting parts not subject to flame action.

Properly designed and properly welded joints are stronger than either flanged, threaded or rolled joints. Precautions, however, must be taken that the material is of suitable character to secure a proper weld and that the welding equipment and operators are effective and efficient. This can be assured by proper supervision, tests and inspection.

Designing for Avoidance of Corrosion and Corrosion Fatigue

Reliability is a *sine-qua-non* in marine installations and weight-saving is most desirable. Corrosion is the great enemy of both. There is no better slogan for the steam plant than *"Eliminate corrosion and design to avoid it."* Metallurgical research during the last ten years has done much to develop corrosion-resisting materials that can be applied to marine practice. The phenomenon of corrosion-fatigue also is being laid bare by investigators so that the marine engineer can, if he wishes, allow properly for the effect of corrosion-fatigue and select materials and corrosion-preventatives that will not only guard against corrosion but also save weight by eliminating excess allowance made for corrosion and for the unknown effects of possible corrosion. In other words, the factor of ignorance may be partially eliminated from the factor of safety. Corrosion of metals used in marine installations is no longer the awful and imponderable mystery that it was a short time ago.

Our metallurgists can now advise us as to the materials most suitable from a non-corrodable standpoint for practically any service; and, furthermore, the comparative rapidity of corrosive action can be predicted. Corrosion-fatigue limits for most of the ordinary materials are being found. With these data intelligently applied, our steam installations should be made much more durable and very much lighter. Let our marine designers look somewhat more to the metallurgist and the testing laboratory for advice and the effort will be most amply repaid. The marine steam plant can be given a new lease of life by taking full advantage of technical research and investigation.

French Ships Being Built in England and Germany

TWO French companies, the French Line and the Compagnie Paquet, have ordered two passenger steamers from Messrs. Swan, Hunter & Wigham Richardson in England and a third company, the Société Générale de Transports Maritimes à Vapeur, has ordered from the same British firm a third passenger steamer of 14,000 tons displacement, 511 feet 9 inches long, to be run on the Marseilles-Buenos Aires line. The placing of these three orders with a British yard, owing to lower prices and quicker delivery, has caused much concern among French shipbuilders, who are in need of work.

On the other hand, the application of the Dawes Plan is continuing to have disastrous effects as far as the French shipbuilding industry is concerned. In addition to three 10,500-ton cargo liners building in Germany for the Pacific Coast service of the French Line, two other ships, a 12,500-ton tank steamer named *Vendémiaire* and a 279-foot motor passenger liner named *Cyrnos,* are under construction in Germany for two French firms under the Dawes Plan. The last named, which is intended for the Corsican service, will be the first M.A.N.-engined French vessel, as well as the first French ship to be built on the Maier system.

Because demands made by French shipowners for loans to be issued under the Credit Maritime have already attained the "200 million francs per year for 5 years" limit provided by the law, it is hoped that a number of orders for new vessels will be placed with French yards in the near future.

Mail Contracts Awarded

THE Postmaster General has awarded several additional ocean mail contracts under the new merchant marine act. A contract for the transportation of mail from Los Angeles to Auckland and Melbourne was awarded to the Oceanic & Oriental Navigation Company, of San Francisco. A contract for mails from New York to Beira, Portuguese East Africa, was awarded to the American South African Line. Two contracts for mails from Pacific coast stations to the Orient, on two routes, have been awarded, one to the Dollar Steamship Line, of San Francisco, for Route No. 25 from San Francisco to Manila, via Yokohama, Kobe, Shanghai and Hong Kong, and one to the Admiral Oriental Line, of Seattle, for Route No. 26, from Seattle to Manila, via the same ports of call.

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Study Outline for Marine Engineers

What the beginner should study—Books and methods of study that are available

By David Gaehr*

IN previous attempts to assist studious readers of this paper, it was assumed that probably only licensed men would be interested in articles on such subjects, and it was considered that the publication would hardly ever be read by any other men in the operating "end" of the handling of ships. However, there is a persistent stream of inquiries from young men of splendid service records, who give evidence of possessing qualifications, which, when developed, will enable them to become good engineers. For guidance in preparing for a short term in some school giving an intensive course preliminary to taking the government examination for a license, the following is offered, and it is hoped that the licensed engineers who read it will pass it along to such worthy young men.

A mere list of books, well chosen and arranged in logical sequence, would be helpful, but few men have the initiative and perseverance to complete, unaided, such a study outline.

To depend on the guidance and encouragement of officers and shipmates *may* prove disappointing.

To stop work and go to school is out of the question for most of these young men.

Few individual friends have the time and the capacity to offer the assistance likely to be needed by the student or to do so by correspondence.

Enrollment in a first-class correspondence school is really the "next best bet" to attendance in a day or night school of good reputation.

"Sizing Up" Correspondence Schools

Effective correspondence methods of teaching require a real school organization, the reputation of which depends chiefly upon the character of its faculty and upon its financial backing. The preparation of instruction material (books, pamphlets, charts, etc.) is very costly, if the illustrations are to be clear and plentiful and the text intelligible, and all presented in convenient and attractive form.

For many years the writer has observed various correspondence schools. Some are very good, some just fair, some "not so good" (mildly speaking). Some are under the direction of men of recognized standing in the professional world, who are graduates of high-ranking institutions, with plenty of teaching experience, while others are merely business enterprises conducted by and for the benefit of individuals, who would not dare to submit their credentials certifying to their training and professional experience.

However that be, nearly all correspondence schools are in business to make money, and the material accumulations of some indicate that they are making lots of it, whereas no first-class educational institution is likely to make money. They are not organized for that. They have to be sustained by the income on large endowments and contributions from public-spirited alumni and citizens of means, else the tuition charges would be prohibitive for most of the young folks they would attract as students.

The amassing of fortunes by some of these correspondence schools should be duly scrutinized, when attempting to place an estimate on their teaching efficiency, which involves the holding of the students' interest and "seeing them through". If they were making merely modest charges for their tuition, such accumulation of wealth would not be possible; but, by collecting in advance, or on a definite payment plan, the entire charge for a course, according to their specified curriculum, with full knowledge and expectation that many, probably the majority, of the students will never complete the course, they actually divert money received to uses other than for the instruction paid for. There is never any refund on instruction not received. A declaration to the effect that they stand ready to "go through" with their part of the contract exempts them legally, though a moral obligation remains unmet.

The American School of Chicago, formerly called the American Correspondence School, has been observed by the writer, with great interest, for about thirty years. Its record is clean and above reproach. It is said to be the only school of its kind not organized for profit. It is heavily endowed and employs a corps of high-grade instructors, anxious to be of individual assistance to any student, who may write in for further explanations, should he strike a snag in the well written text-books. These text-books are prepared in very practical form, and in convenient installments of small-sized books, which are better to carry around and spend odd moments with than are large comprehensive volumes. The courses are offered in units, which are integral parts of the outlines recommended and can be enrolled for, course by course, starting wherever the student believes himself qualified to start. The price is commensurate with the actual instruction received.

The American Technical Society of Chicago is the publisher of the books used by the American School and much of the material that is used in the school's work can be secured by purchasing the material in text-book or cyclopedia form through the American Technical Society.

Preparatory Subjects

Every "likely" chap should be induced to adopt a regular study plan as soon as he manifests that he is capable and worthy of development into an engineer. He should be encouraged to devote a definite amount of time each day upon such studies, with the determination to cover a specific division of the work by a definite date.

The writer has looked over and examined the following text-books of the American School of Chicago and recommends taking them up in the order given. None of them is pretended to be an exhaustive treatise but the knowledge acquired through them is sufficient for the immediate needs of a young engineer.

Thirty-six months' service in the engineers' department of a steam vessel is required before a candidate for a license may present himself for the government examination. If a candidate begins his studies shortly after he has started "sailing", he should follow the outline of studies as given; if he begins his studies much later, he may omit those subjects prefixed by an asterisk (*), which are really not necessary in order to pass the govern-

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ment examination, but which afford excellent training for the mind. This, however, may be postponed until after a man is "operating on his license".

Practical Mathematics—Parts 1, 2, 3, and 4, each with "Study Helps".
Study Outline for General High School English and English for Immediate Use, with Drill on Essentials.
*Study Outline for a Year of Algebra, with Answer Book.
*A Year of Algebra.
*Plane Geometry.
*Trigonometry and Logarithms, Parts 1 and 2.
*Practical Physics, Parts 1, 2 and 3.
*Chemistry.

Note: While the last two subjects are not absolutely essential in the preparation for the following technical subjects, yet the student will find the latter so much easier to master, if he possesses such ground work. The three preceding subjects are wonderful means of developing the reasoning powers. Any high school graduate may reasonably dispense with their consideration, as he is supposed to have studied all this even more thoroughly and extensively than is done in these brief outlines.

Others than high school graduates ought to be able to cover the outline of studies, as indicated above, in at least two sailing seasons.

Technical Subjects

On the Great Lakes it will take at least four sailing seasons, in order to serve the required thirty-six months. The following can be covered in two sailing seasons:

Types of Boilers.
Construction of Boilers.
Boiler Accessories.
Boiler Practice.
Pumps.
Steam Engines, Including Consideration of the Propeller.
Valve Gear.
Steam Engine Indicator.
*Steam Turbines, Parts 1 and 2.
Refrigeration.
Electricity, covered in fifty-four booklets, of which a marine engineer really needs but the following:
1. Magnetism.
3. Current Electricity and Primary Cells.
5. Fundamental Principles.
13. Battery-Charging Apparatus.
14. Care of Storage Batteries.
15. Repairing and Charging of Storage Batteries.
17. Indicating Meters.
23. Electro-Magnet and Coil.
24. Principles of Dynamos.
25. Armature Construction.
27. Field Magnets and Commutation.
28. Direct-Current Generators.
48. Direct-Current Switchboards.

Note: To date this school has not prepared texts on steering engines, deck engines, etc., and it would be well to supplement the above studies with the Navy booklets, referred to in the writer's article of August.

There is also a very helpful set of booklets issued by The Division of University Extension, Massachusetts Department of Education, "For Class and Correspondence Instruction and for the Bureau of Navigation, United States Navy" on "Practical Steam Engineering", published by John Wiley & Sons, Inc., New York city. There are twenty assignments, in as many booklets, in this set. The same publishers issue, for the same purpose, twelve assignments on "Curtis Turbines" and twelve on "Parsons Turbines," and also twenty assignments (in 7 booklets) on "Practical Electricty for Electricians, Electrical Machinists and Others."

It is to be remembered that all of the booklets mentioned in this division of the study outline (except the Navy booklets) are written primarily for stationary practice, but, as there is nothing of this nature as yet issued especially for marine practice, a student may leave out irrelevant material and substitute special trade literature supplied by manufacturers of marine equipment.

Other Helpful Studies

In the old days, sea-going engineers were mostly men who had served their apprenticeships in the shops building marine engines and boilers. That knowledge served them in good stead in breakdowns. Often engineers are expected to make quick repairs, which they can do so much better if they have a pretty good idea of how their power plant came into being.

*Blue-print Reading.
*Pattern Making, Parts 1, 2 and 3.
*Foundry Work, Parts 1 and 2.
*Machine Shop Work, Parts 1, 2, 3, 4 and 5.
*Boiler Work.

Indeed, in the examinations upon the strength of which Navy officers receive promotions, many questions refer to the above subjects.

*Geared Turbine Drives.
*Diesel Engines and Drives.
*Electric Drives.

After the preparatory studies, it is very beneficial if the candidate for a license can attend some school giving a short course in (marine) steam engineering where there are models for the practice of valve setting, pump models, etc. A little personal instruction under a competent instructor brings quicker results than long, weary hours of individual study.

Electric Ships

By Rear Admiral Bradley A. Fiske, U. S. N., (Retired)

THE brilliant triumph of the electric ships, of which the United States Navy has eight (and no other navy has any), is far more amazing to naval officers than to civilians, for the reason that fifty years ago there was no electricity whatever used in our navy, except that, in a very few ships, there was an electric bell by which the captain in his cabin could call the orderly outside. Just fifty years ago, the U. S. S. *Plymouth* was supplied with that device. I know this because the bell was continually going on a strike, and I was continually receiving orders to go into the cabin and make it work.

For many years thereafter, little progress of any kind was made. Because of the pacifist sentiment with which all Americans were then infected in a far greater degree than now, no new ships were built, and the Army and Navy were regarded as virtually useless. But in 1881, an agitation brought on by a few naval officers, headed by Rear Admiral Luce, resulted in inducing Congress to appropriate for the *Chicago, Atlanta, Boston* and *Dolphin*, and to fit them with modern engineering appliances of all kinds.

Since then, the naval profession has progressed more rapidly than has any other profession, except that of electrical engineering, which started from zero about that time. Every succeeding group of ships has been more scientifically designed, more ably constructed and more fully equipped than the group which had preceded it.

Besides that, new kinds of ships have come into being, the like of which were not even dreamed of fifty years ago. Of these new species, the submarine and the airplane are the most recent.

In all of them, scientific apparatus of every known kind is used throughout; but in the "electric ships," electricity is employed almost exclusively. The first use of electricity for moving heavy masses was made by the General Electric Company, in 1896, when it fitted two turrets of the U. S. S. *Brooklyn* with electric turning apparatus. This was tried out carefully, in competition with the two other turrets, that had been fitted with steam gear by the Navy Department. The result

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was an undisputed triumph for the electric gear. I know all about this, because I was the humble instrument used by Rear Admiral Sampson, to work with the General Electric Company, and bring this thing to pass. Sampson was compelled to stand alone, opposed by nearly all the higher officers of the Navy, and hindered in certain ways by the department itself. This is only one of the many services that the Navy owes to Sampson.

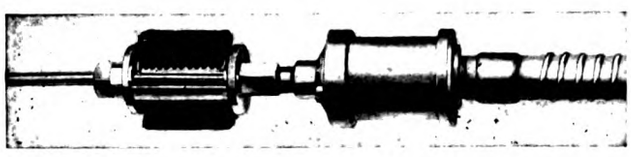
In September, 1896, after the *Brooklyn's* electric apparatus had been installed, but before it had been tested, I published an article in the U. S. Naval Institute, called "Electricity in Naval Life," in which I gave a carefully controlled rein to my imagination, and urged its use for virtually every purpose on shipboard for which heat, power or light is needed. This article almost ruined my reputation for common sense, and listed me as a crank. But nevertheless all of the suggestions made in it are now carried out in our colossal electric ships, six of which have been equipped by the General Electric Company, and two by the Westinghouse Company.

These ships constitute the grandest of all the triumphs yet made by the minds and wills of men. No such gigantic use of man-made power can anywhere else be found. And no such delicate use of man-made power can anywhere else be found. No quadrille or dance of any kind can equal, in grace and precision, the maneuvers of a fleet upon the sea. No group of human beings, when doing anything whatever, can give the demonstration of co-ordinated intelligence, power and docility that they give, making their harmonious movements, in obedience to the signals of the Admiral. The grandest sight in all the world is a fleet of warships maneuvering on the sea.

Controlled by the minds of men, electricity makes this possible.

Applying Apexior to Boiler Tubes

A COMPLETE line of equipment for applying Apexior (protective coatings for preventing corrosion) to the internal surfaces of boiler and economizer tubes has been developed by the Dampney Company of America, Boston, Mass. For using the Dampney Powercoater, the device for applying Apexior,



Power-coater used to apply Apexior

it is necessary to have available an adequate supply of compressed air, air hose and air-driven boiler tube cleaners, all of which are essential in the modern power plant for the regular cleaning of the internal surfaces of the tubes. A typical example of the application of Apexior to a watertube boiler having 4-inch straight horizontally-inclined tubes is given below:

Method of Cleaning Tubes

First, the boiler tubes are cleaned by means of the air-driven turbine cleaner, to remove rust, scale and the like. The scale-cutting head is then removed from the tube cleaner and the Powercoater is attached to the motor shaft. One of the two operators usually required to carry on the cleaning operation then inserts the Apexior depositor through the hand-hole opening in the header and into the end of the tube. By pressing down on the plunger and then withdrawing the depositor, just the right amount of material is deposited in the tube. As the Apexior begins to flow slowly down the walls of the tube the second man, operating the Powercoater, inserts it into the front end of the

Process of coating tubes with Apexior to prevent corrosion

tube. The compressed air is then turned on and, by means of the air hose, the device is pushed down the length of the tube until the stop rod on the front end hits the cap on the back header. The Powercoater is then run back through the tube and the process is repeated on the next one.

Time Required

It is stated that less than a minute per tube is required to thoroughly cover the walls with Apexior. During this operation the Dampney Powercoater is revolved at fairly high speed and the bristle brush units, by means of centrifugal force, expand and press against the sides of the tube, thus thoroughly brushing a uniform coat of Apexior into all the pores of the metal throughout the entire length and diameter of the tube. These brush units are so attached to the frame that they accommodate themselves to any unevenness of the tube. For boilers with curved tubes connecting the drums, the principle of operation is the same, except that the depositor is of a slightly different type and the Powercoater, which is made to conform to the tubes, is utilized.

The Dampney Powercoater and miscellaneous brushes and fittings for this work are available for any size or type of boiler or economizer tube either straight or curved.

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Damping the Rolling of Ships

Frahm's anti-rolling tanks widely used in German vessels to prevent rolling

By H. Schreck

ALL large rolling motions observed on vessels at sea have been traced to the action of syuchronism between ship and wave. The ship is struck by a series of relatively uniform waves in time with her natural vibration and thereby receives an amplitude which increases with every wave-impulse.

The conditions under which synchronism between ship and waves may occur vary widely. Conditions of the wind and of the sea play an important role, also the direction in which the advancing waves meet the ship. It is well known that the waves directly from astern, or diagonally from astern, cause the rolling of the ship more easily than those from any other direction. Finally, the speed of the vessel affects the wave-impulses, which will be slowed up the faster the vessel travels and, therefore, will not reach the range of the period of natural vibration of the vessel. It is apparent, therefore, that every ship, even the large transatlantic express steamers, can meet with conditions which will cause heavy rolling.

The problem of damping the rolling motion was solved some time ago by Dr. Frahm, director of the Blohm & Voss shipyard, Hamburg, Germany, by applying the laws of resonance action to masses of water arranged in special tanks.

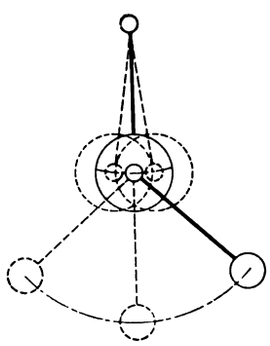

Fig. 1

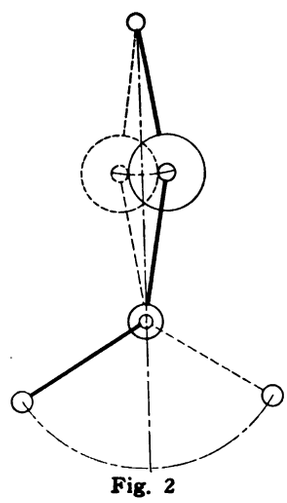

Fig. 2

The principle of resonance may be demonstrated in the following example:

Suppose a pendulum is suspended from a large, heavy pendulum, (Fig. 1), both of which have a definite and equal frequency, then the second pendulum will be made to swing by the motion of the first one. The original pendulum imparts the impulses to the second one, the amplitude of which will increase with every stroke, as both have equal frequency, until the latter will have a very wide movement. Its maximum amplitude will be reached when the first pendulum is already back in its middle or vertical position. The second pendulum, then, is lagging behind the first one by one-quarter of its complete period of vibration.

If a third pendulum of lesser mass but of equal frequency is suspended from the second pendulum (Fig. 2), the third pendulum will also be made to swing by the second one and to an amplitude which is increasing with every stroke, again due to synchronism. This third pendulum lags behind the second one by a quarter-period, or a half-period behind the first one. Due to reaction, the third pendulum will also impart impulses to the second pendulum, which, however, will counteract the impulses of the first pendulum on account of a half-period displacement, and the second pendulum will almost come to rest, leaving only enough oscillation sufficient to keep the third pendulum in motion. The latter will show a very large amplitude in this condition.

Resonance Phenomenon Applied to Ships

This phenomenon has been applied to the rolling motion of ships by providing a mass of water, which is oscillating like a pendulum and has the same frequency as the ship, forming a similar three-pendulum-system, consisting of the waves, the ship and the water in the anti-rolling tanks in the ship. Such an arrangement is shown in Fig. 3. The tanks are connected to each other at the bottom by a channel *H* and at the top by a pipe, with a valve *D* interposed, by means of which the tanks can be put in or out of operation. The area of the lower channel is proportioned in such a way that the frequency of the ship and of the water in the tanks is the same. In case the waves have the same frequency, the ship, similar to the second pendulum, will be brought to co-vibration. Here again her phase of vibration is lagging by a quarter-period behind the imposing wave, which means the ship reaches her maximum heel a quarter-period later than the wave, on its forward motion, has its maximum slope in relation to the ship.

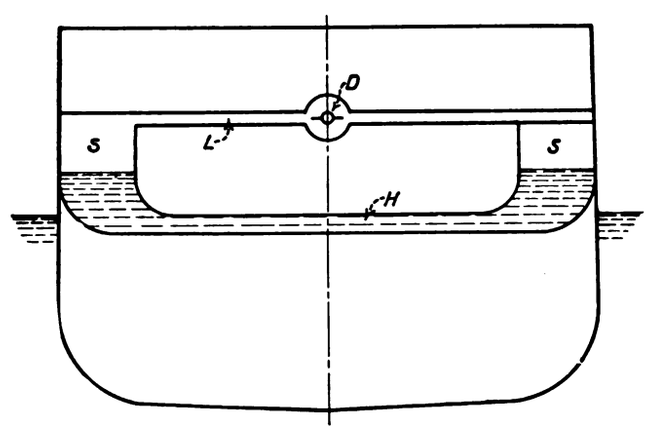

Fig. 3

The water in the tanks, like the third pendulum, will lag a quarter-period behind the ship and a half-period behind the waves and will, by reaction, impart impulses to the ship, which are directly opposite to the wave-impulses. Therefore, the ship, like the second pendulum,

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will come almost to rest, while the water in the tanks will oscillate heavily. If it is desired to eliminate temporarily the effect of the anti-rolling tanks, the valve *D* may be closed. The entrapped air will then prevent any flowing of the water from one side of the tank to the other, and the ship will travel as it would without the tanks.

The effect of these anti-rolling tanks was studied first on models of ships of various types. A leaf spring, attached to the model, was bent back and forth by a crank-drive in order to produce the oscillation of the ship. Later on, the models were caused to roll by actual waves. All of these model tests confirmed the correctness of the above principle of damping of rolling motion, and gave at the same time the theory by which to calculate the dimensions and correct shape of the tanks.

Frahm Anti-Rolling Tanks Used in 1910

Frahm anti-rolling tanks were first applied to vessels in 1910 when they were fitted to the *Ypiranga* and *Corcovada* of the Hamburg-American Line. These two vessels were rolling to such a degree that their acceptance was in doubt. The installation of two tanks on these vessels converted them to smooth and comfortable sea vessels, and their acceptance was readily effected.

From then on, up to the time of the war, a number of vessels already in operation were equipped with these tanks, including, among others, the *Amerika, Meteor* and *Kaiserin Augusta Viktoria* of the Hamburg-American Line, and the *Eleonore Woermann* of the Woermann Line. The favorable results with these ships caused these companies to provide anti-rolling tanks on all of their ships then under construction. During this period, 33 merchant vessels with a displacement of 660,000 tons, as well as several naval vessels were equipped with anti-rolling tanks.

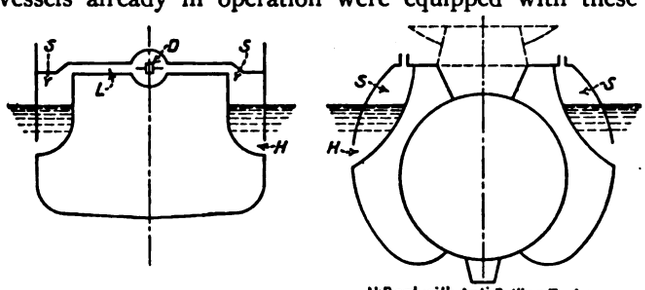

Fig. 4

Much interest in the Frahm tanks was displayed by foreign countries, in particular by the former Imperial Russian Navy, which after investigation in 1913 recommended the installation of anti-rolling tanks on all naval vessels then under construction or subsequently to be ordered. This recommendation was carried out on all vessels then under construction and was continued until the war changed the government in Russia when all further work on the building program was stopped.

During the war, activity in this line naturally lagged in the merchant marine, but the German Navy began to realize the importance of damping the rolling motion of battleships. The difficulty here of the added weight of the water in the tanks was overcome by using fuel oil instead of water, thereby utilizing a part of the necessary and useful load. Six torpedo-boats, built during the war, which were equipped with anti-rolling tanks using fuel oil, gave such excellent results that it was planned to equip three small cruisers with tanks, only one of which, however, was completed. Twelve additional larger torpedo-boats were to be similarly equipped, but only one was finished in time to be tried out in operation.

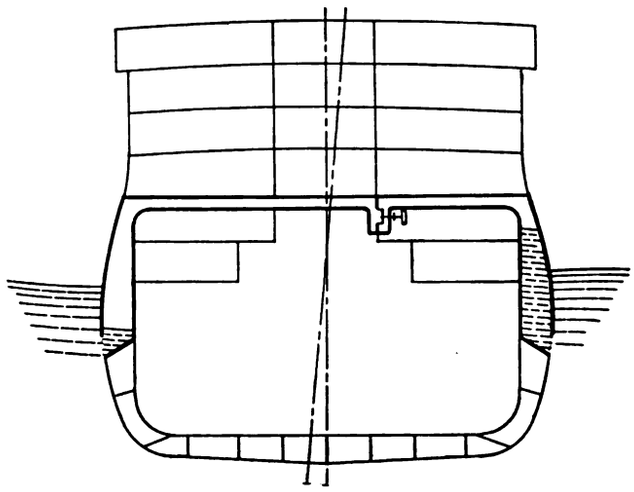
Fig. 6

U-Boats Present a Special Problem

With an increasing demand for U-boats, the problem arose as to how to protect this type of vessel from rolling. The general layout of these vessels did not lend itself to an arrangement of the tanks in their present form since it is difficult to provide for a cross-channel for the water communication with the given layout of the hull. For this reason, an arrangement was resorted to which had been tried during the early development of this work.

In this arrangement (Fig. 4), the tanks have no cross-channel for communication. The two tanks *S* are provided with holes *H* in the outer hull, communicating with the sea. When the vessel is at rest on the surface, the water level in the tanks and outside is the same. As soon as the ship starts rolling, the level in the tanks will rise and fall by admitting water from the outside through the holes and losing it in the same way in the tank on the other side. By proper proportioning of the holes it is possible to produce an oscillating motion of the water in the tanks so that it will lag a quarter-period behind that of the ship and thereby produce the same damping effect as was obtained with the masses of water oscillating in the U-shape tanks. The air spaces of both tanks are again connected by a pipe with a closing valve *D* by which the motion of the water in the tanks can be interrupted. If the latter provision is dispensed with, the air connection can be omitted and an opening in the upper part of each tank is sufficient.

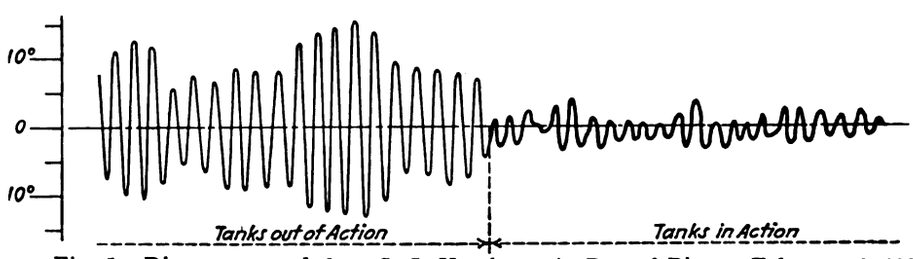

Fig. 5.—Diagram recorded on S. S. Ussukuma in Bay of Biscay, February 4, 1922

In this simplest possible form anti-rolling tanks were built in on U-boats during the war. A small part of the space between the inner pressure body and the outer hull, which is used otherwise as a submerging or fuel-oil tank,

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is used for this purpose. Boats equipped in that way have shown excellent sea-worthiness according to the reports of the commanding officers.

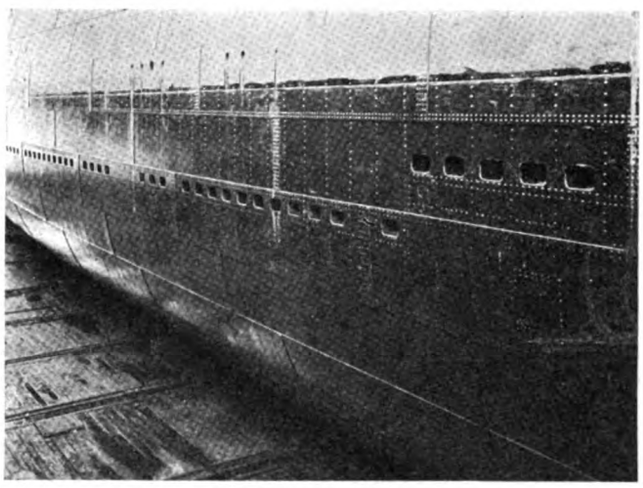

Fig. 7.—Side of the steamship Hamburg, showing the openings of the anti-rolling tanks in the hull

German Liners Being Fitted With Anti-Rolling Tanks

During the post-war period, the use of Frahm anti-rolling tanks was continued in the reconstruction of the German merchant fleet. Experience has shown that either the U-shape tanks or the plain side tanks with openings in the outer hull are equally satisfactory. The preference for one or the other arrangement is controlled principally by the general layout of the ship. The new ships for the Africa service of the Woermann Line, the German East-Africa Line, and for the Hamburg-American Line were equipped with tanks after the older system, that is, with the cross-channel for the water. It had shown such excellent results in several directions, that it was not considered desirable to dispense with it. Fig. 5 shows the effect of the anti-rolling tanks on the *Ussukuma* of the German East-Africa Line.

The installation of Frahm anti-rolling tanks on the Hamburg-American liners *Albert Ballin, Deutschland, Hamburg* and *New York* is of special interest on account of the shape of the hulls of these vessels. In order to secure a wider beam for increased stability, bulges were provided on each side of the hull near the waterline and extending over two-thirds the length of the vessel. In this way, suitable space was available for the arrangement of tanks with openings in the outer hull, as is shown in Figs. 6 and 7. Over the range of the expanded hull, that is, over two-thirds of the length of the ship, tanks are provided which submerge under water to about one-half of their height. Longitudinally, these tanks are subdivided by bulkheads into three spaces. They have longitudinal openings in the hull for communication with the outer sea water, and the corresponding tanks on opposite sides of the vessel are connected by an air channel fitted with a valve by means of which the tanks can be taken out of action, if so desired. A typical record from one of these vessels is shown in Fig. 8. In this case the roll of 16 degrees to either side with the tanks cut out was reduced to between 2 and 5 degrees with the tanks in operation.

During the post-war period 21 ships of 452,000 tons have been or are being equipped with these tanks for the various companies previously mentioned. In addition they have been installed on ships of the North-German Lloyd, Svenska American Line, Hamburg-South American Line, and others. The space required for their installation is negligible. The amount of water required is 1.3 to 1.5 per cent of the displacement. The reduction of rolling in this way not only makes the vessel more attractive to the traveling public but also results in a minimum loss of speed during unfavorable weather, decreased transverse stress in the hull and improved steering and maneuvering qualities in the vessel.

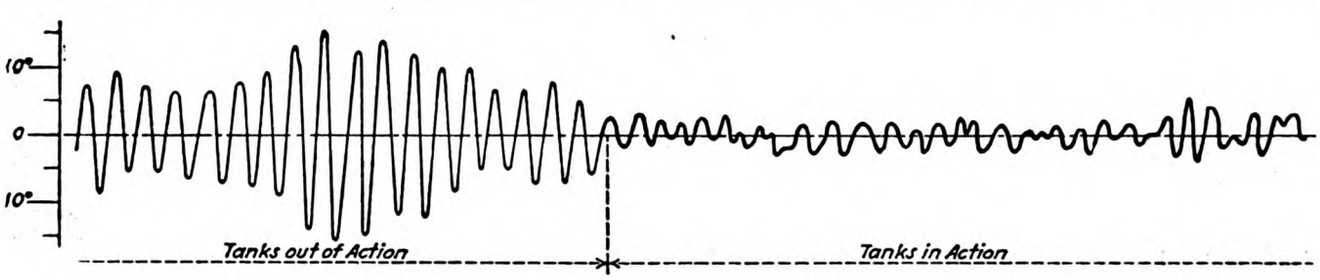

Fig. 8.—Results of tests on S. S. Deutschland while on a voyage from New York to Hamburg, July 9, 1924

Westinghouse Engineers Unravel Mysteries of Blade Breakage

WHAT is probably the world's noisiest scientific instrument is the machine built for testing turbine blades at the South Philadelphia Works of the Westinghouse Electric & Manufacturing Company, by means of which many perplexing mechanical and metallurgical problems relating to the breakage of steam-turbine blades have been solved.

The machine consists essentially of a heavy vertically-mounted, cast-iron hammer which can be swung back and forth between two anvils by a system of compressed-air-operated springs and levers. The blades to be tested are mounted on the hammer and are ordinarily jarred to destruction.

These tests have disclosed that the life of a blade is practically tripled if its edges are carefully rounded off instead of being left sharp, as was at one time considered essential to good blade performance. Another discovery is that if the edge of a blade be cut with a sharp nick, a crack is prone to develop at this point, ultimately leading to breakage. Fortunately the slight nicks and dents unavoidably sustained in handling do not partake of the knife-like sharpness which leads to fractures. The tests have led, however, to an increased vigilance in the inspection of all finished blading.

Much light has also been thrown on the most durable forms, dimensions, and materials for turbine blades, as well as the most desirable methods of mounting, lashing, shrouding and other details; and it is now possible to design turbine blades which are known to be more than amply durable for the service intended.

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Making the Marine Safety Movement Attractive to the Personnel*

Rigid medical examinations of ship crews— Bonuses for reducing accidents on ships of the Export Companies' fleet

By Herbert Herbermann†

ALTHOUGH the personnel aboardship is amply protected and cared for in case of accident or illness, the methods employed must of necessity differ somewhat from those applied in shore plants where doctors, nurses, ambulances, hospitals, and the like are available. On a freighter at sea, for example, the master becomes the doctor and nurse of the patient. This does not mean that the patient is entirely in the hands of an amateur, however, for in securing his license the master must have passed certain medical examinations.

The reduction of accidents and illnesses among the floating personnel have long been uppermost in my mind, both in their relation to the welfare of the men and to the efficient operation of the fleet. Believing that a great number of illnesses would be eliminated if our officers and crews were in perfect health before signing on for a foreign voyage, we have established our own medical department under the direction of an experienced physician. Each officer and man applying for a position must undergo a most rigid physical examination to determine his fitness. Upon the doctor's recommendations the applicant is either accepted or rejected.

The medical office was completely organized and began operation February 11, 1927. During the year 2246 examinations were made. Of this number 1686 were original examinations and 560 were examined one or more times. Employed on all vessels of the Export Company as of January 1, 1928, there were:

779 men who had 1 examination
303 men who had 2 examinations
131 men who had 3 examinations
55 men who had 4 examinations
8 men who had 5 examinations
1 man who had 6 examinations

Of the 2246 men examined, about 10 percent were disqualified for physical defects. Some of the causes for disqualification were heart disease, color blindness, hernia, cataracts, very poor vision, tuberculosis, dental cases and others.

During the year 1926 our statistics show 135 cases of illness and 187 injury cases. In 1927, statistics show 151 cases of illnesses and 186 injury cases. These figures show an increase in 1927 over that of 1926 on illness cases of about 12 percent, while the injury cases in 1927 as compared to 1926 remained about the same.

Safety Committee Formed

In order to instill in our organization an idea of the necessity for safety on the piers and aboard the various vessels, we created a safety committee consisting of the heads of the various departments vitally interested in the actual operation of the steamers and the pier terminals. This committee consists of seven members, who meet once a month to discuss safety recommendations made by members of the committee or by any other individual of our organization. While the recommendations, in some cases, have been quite expensive, we have not as yet disallowed any expenditure applicable to the common safety on board steamers or in the dock terminals.

Each individual vessel in the fleet has its own safety committee consisting of the master as chairman, chief engineer, chief officer and chief steward. Meetings are held during the voyage at the discretion of the master and recommendations and minutes of these meetings are submitted, upon the return of the vessel, to the committee ashore for disposition.

Now, having what we believe to be a perfectly healthy crew, through the efforts of the medical department, and having formed a committee on board ship so that the members of the crew could be taught to take care of themselves and be protected from accidents as far as was humanly possible to do so, we felt that we must go further than this and consequently created a "Safety-First Bonus Program."

Bonuses Offered for Safety Work

Although the safety-first campaign is a somewhat new departure among the sea-going fraternity, it must be emphasized that it has achieved a marked degree of success in other walks of life. We, therefore, could see no reason why the results should not be equally successful aboard ship. To encourage the safety-first policy by men in the employ of the different ships, it was proposed that the vessel having the lowest expenditure for illnesses and injuries over a period of one year, which constitutes four consecutive voyages in our trade, would fly a "Safety Pennant," and all officers and members of the crew who were part of the ship's personnel for that entire period would receive a bonus equal to two weeks salary, or a part proportionate to the number of voyages they made in the successful vessel.

It was decided, that in order for the ship's personnel to take advantage of this bonus system, they must be in the employ of the corporation at the termination of the fourth voyage. The officers and members of the crew of the successful vessel would be entitled, if they had completed four voyages, to two weeks salary; if they had completed three voyages to three-quarters; if they had completed two voyages to one-half of two weeks salary; and if they had completed one voyage to one-quarter of two weeks salary. This plan has created a spirit of friendly rivalry among the personnel which has been of great benefit both to the employees and to the corporation. It has further reduced the medical and hospital expenses, reduced injuries, and has eliminated much loss in time by men engaged in a business which involves a certain degree of hazard.

* Abstract of a paper presented at the annual meeting of the National Safety Council, Marine Section, held in New York city, October 1 to 5.
† President, Export Steamship Company, New York city.

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Classification and Safety of Ships*

Necessity for load-line regulations—Functions of Classification societies—1929 International Safety at Sea Conference

By Captain Charles A. McAllister†

AT the International Shipping Conference, held in London in June of this year, the following statement was made: "In the last fifty-five years British shipping has averaged 4,000,000,000 passenger miles per annum and 200 passengers have been drowned per annum, or one passenger to every 20,000,000 miles."

Although it has been said that one can make any kind of a case from statistics, this is surely a remarkable record and shows wonderful progress from that of the seven years 1846 to 1853, when no fewer than 61 British emigrant ships were lost at sea, a state of affairs which resulted in the Merchant Shipping Act of 1854, the beginning of active government control in British shipping so far at least as the laying down of safety regulations was concerned. There is no doubt travel on the high seas is becoming increasingly safer, and this is due in a large measure to the growth in size of ships, the change from wood to steel as a material of construction combined with the application of scientific methods to structural design, the change from sail to mechanical propulsion, to superior navigating equipment and aids to navigation, to government safety regulations, the licensing of officers and engineers, and last but not least, to the beneficent influence of the various classification societies' rules and regulations.

Hazards Encountered by Ships

The principal casualties to which vessels are subject are foundering through stress of weather, stranding and collision, where the damage may be such that water will enter in sufficient volume to offset the reserve of buoyancy and the ship sinks, in which case the only chance of saving the lives aboard is by the provision of suitable and adequate life-saving appliances. From the point of view of safety to the ship herself it is essential that she be what is termed in nautical parlance, "seaworthy."

The essentials for a seaworthy ship and the main requisites for safety are: Sufficiency of structural strength, a proper measure of stability, suitable freeboard, reliability of machinery and proper equipment. It is obvious that to be seaworthy for a particular voyage a vessel must also be efficiently manned and have sufficient fuel, fresh water, etc.

In addition to the main considerations of structural strength, stability, and freeboard it is obviously desirable (especially in a ship carrying a large number of passengers) that she be efficiently sub-divided with the largest practicable number of bulkheads, so that the vessel will remain afloat after serious damage or at least keep afloat as long as possible and so increase the chances of getting the passengers and crew safely transferred to the boats and to shore or another ship.

The safety of the vessel herself and of the valuable lives aboard in the event of a disaster to the ship are essential considerations in the design of a passenger vessel, but ship design is peculiar in the sense that any policy of playing safe entails a serious economic handicap to the owner, for while sufficient structural strength must be provided (and the structural problem does not lend itself to exact mathematical treatment) any excess of hull material not only entails increased costs of construction, but must be carried around for the life of the ship, with resultant loss of cargo deadweight.

Every ship would have a suitable measure of stability for the service conditions without requiring undue care in loading, but care must be taken not to render the ship too stiff if she is to be popular with passengers, who, as a class sometimes ignorantly prefer comfort to safety. Again, a high standard of sub-division is desirable and in my opinion reasonable bulkhead requirements should be required by law in the case of passenger vessels.

Rigid Regulations

There is no commercial undertaking in the world today that is regulated to such an extent as the shipping business. This is due to the hazardous nature of the seaman's occupation in earlier days and in some measure to the fact that the shipping business is international in character and highly competitive. Major disasters at sea receive so much prominence that the various governments are from time to time forced by pressure of public opinion to enact new and to amplify existing safety regulations.

Government control is universal and indeed essential in connection with such matters as the admeasurement of tonnage, which besides being the basis of dock dues, etc., is useful for statistical purposes; the entry of vessels into the national registry; the enforcement of rules of the road for the prevention of collisions at sea; detention of ships alleged to be unseaworthy, and restrictions on loading. Overloading beyond the regulation freeboard markings is one cause of detention and prosecution in every maritime country except the United States, which has as yet no compulsory load-line law.

It is most regrettable that there is not a line in our statute books concerning load-line requirements, which is fundamentally the basis of safety at sea. Numerous attempts have been made, covering many years, to bring about legislation of this kind in America, but to date nothing has been accomplished, although bills have several times passed either one or the other of the branches of our national legislature. A bill passed the Senate during the first session of this Congress, but it will require the united efforts of all persons interested in shipping to procure final enactment.

Classification Societies

The classification societies in existence today are Lloyd's Register, and the British Corporation with headquarters in Great Britain, Bureau Veritas in France, Norske Veritas in Norway, Germanischer Lloyds in Germany, Registro Italiano in Italy, and the American Bureau of Shipping in the United States. Some of the older societies make pretensions to being international

* Abstract of paper presented at the annual meeting of the National Safety Council, Marine Section, held in New York city, October 1 to 5.
† President, American Bureau of Shipping, New York city.

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as far as the scope of their operations is concerned, but the working alliance and mutual agreement of the American Bureau, British Corporation, Registro Italiano and Imperial Japanese Marine Corporation, by which the surveyors of each society carry out in its own territory surveys on behalf of the other parties to the agreement, is truly international and co-operative in the best sense.

The principal functions of a classification society may be briefly stated as follows:

A.—To provide a register book giving essential particulars of the hulls and machinery of the vessels classed with the society, the classification assigned to each vessel, together with the dates when surveys were carried out, etc.

B.—To issue certificates of character for merchant ships, their machinery and equipment, i.e.; classification certificates, certificates of seaworthiness, etc.

C.—To prepare rules for the construction of hulls and machinery, including material specifications and detail regulations for the carrying out of periodical surveys, etc. The rules are necessarily modified from time to time to keep pace with developments in shipbuilding and marine engineering, and are the standard by which the eligibility of a vessel submitted for classification is determined.

D.—To carry out other work relating to the structural design, construction, and maintenance of merchant ships such as the assignment of freeboards which may be delegated to the society by the proper government authority; also when specially requested by owners or builders to investigate questions such as sub-division, etc., which affect the safety and seaworthiness of the ship.

1929 Convention for the Safety of Life at Sea

The shipping business being more or less international in character, is extremely desirable that the various maritime nations should reach agreement on general principles governing safety regulations if only in view of the great convenience to ship owners which results from the mutual acceptance of each others national certificates. Largely due to the war, the 1913 International Convention for the Safety of Life at Sea was not generally ratified by the governments concerned. Since that time, however, passenger ships have been built in substantial accordance with the convention rules, and the experience gained thereby shows that some modification of the regulations is desirable.

It is for this reason that the International Conference to be held in London next spring is so extremely important, and you may be interested to know that a Ship Construction Committee under the chairmanship of Admiral George H. Rock was recently formed under government auspices with a view to investigating the whole question of safety of life at sea in order that the delegates from the United States to the forthcoming conference will be fully informed as to the views of our ship owners and builders. I fully anticipate that international agreement will be reached at this conference and that the 1929 convention will be ratified by all the principal maritime nations. It might not be out of place here to express what I consider to be the essentials for safety regulations in general and particularly those affecting merchant shipping:

a. Government supervision should be kept to a minimum. Regulations should be international in character as far as practicable.

b. The shipping law should provide the necessary administrative machinery, and as safety requirements are concerned should confine itself to general principles, leaving the proper administrative authority, i.e.; Department of Commerce, power to lay down detail rules in accordance with these principles and to modify same from time to time with developments in shipbuilding and marine engineering.

c. The rules and regulations should be fairly and equitably administered by competent and proper authorities with due regard to uniformity of action in the various ports and districts.

d. Unnecessary duplication of surveys and inspection should be avoided. In this connection the various governments concerned should as far as practicable recognize the certificates of their own national classification societies.

Safety on American Ships*

Methods employed on the Great Lakes and west coast to promote safety—Strict code required

By H. B. Walker†

On the Great Lakes safety education has been carried on through ship safety committees for a number of years with splendid results. Each committee is composed of six men. The committee holds a meeting once a month upon the call of the master of the vessel, at which the master and chief engineer are present in an advisory capacity. These committees consider various questions of safety, discuss accidents, give instructions to new men, etc. The members of the committees are paid for their attendance at the meetings and, if no accident occurs to any member of their crew during the season, necessitating his absence from the ship, a bonus is paid to the members of their committee.

As a result of their experience a Code of Recommendations has been issued covering the following; ladders, tackle, gear and stagings, machinery, lights, hand rails and gratings, pipe lines, boilers, valves, hatches, cables, loading and unloading, fire, life preservers, etc.

In Seattle, safety education is conducted by the Waterfront Employers' Association in which both employer and employee have representation. This association, by means of careful employment selection, has greatly reduced the high labor turnover in the stevedoring industry, which has resulted in a more steady employment for the men, with increased earnings.

In San Francisco there is also a co-operative movement. The Pacific American Steamship Association, the Shipowners' Association of the Pacific Coast, and the Waterfront Employers' Union have organized an Accident Prevention Department which began to operate in 1927.

Dinner meetings for executives, for chief stevedores, for gang bosses, and others are held, and have done much to stimulate safety thinking. Bulletin boards and special safety slogans, standardized first-aid kits, and first-aid stations are being used with success. Special safety letters and reports and studies on various subjects are issued from time to time. Accident statistics are compiled and regularly submitted to the membership. These reports are carefully analyzed, the accidents segregated by causes, and use in various ways to impress upon the personnel the necessity for "safety" in their daily work.

Recently the accident-prevention campaign has been

* Abstract of paper presented at the annual meeting of the National Safety Council, Marine Section, held in New York City, October 1 to 5.
† President American Steamship Owners' Association, New York city.

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enlarged to include the harbors of Los Angeles and San Diego. Several of the companies are developing safety departments within themselves, and in some instances have safety committees working both on shore and on ships. A program of accident prevention for ships at sea is also under consideration. Rules governing safe practices, duties of hatch tenders, stevedoring foremen, etc., are in course of preparation.

Galveston is also carrying on an active campaign.

On the Atlantic Coast the co-operative movement of shipping organizations and individual steamship companies in combating the great evil of avoidable accidents has probably had its greatest impetus. This has been accomplished through the activities of the Marine Section of the National Safety Council in which many of the leading American shipowners and operators hold membership and whose representatives meet monthly for the exchange of information.

The American Steamship Owners' Association has recently become interested in this very important subject and has appointed a safety committee. This committee has in mind the formation of safety recommendations based upon the practices of those of our members who have been carrying on campaigns of accident prevention for some time. It is believed that this will do much to interest the executives of other companies in the work, and that it will materially increase the number now engaged in it.

Safety Code Needed

There can be no doubt that the preparation of safety regulations or safe practice handbooks, such as have been prepared on the Great Lakes and in Seattle and are under consideration in San Francisco and by the American Steamship Owners' Association, is a distinct forward step. Under the Longshoremen's and Harbor Workers' Compensation Act, which was enacted by the Sixthy-ninth Congress, the United States Employees' Compensation Commission is authorized to "make studies and investigations with respect to safety provisions and the causes of injuries in employments covered by this Act and shall from time to time make to Congress and to employers and carriers such recommendations as it may deem proper for the best means of preventing such injuries." It is reported that steps have already been taken by the commission toward an investigation of the subject with a view to the formation of a marine safety code.

A code, if developed, in my opinion should set forth only minimum requirements, for the reason that past experience has proven that whenever codes are prepared they are likely to be enacted into law. The chief objection to this procedure is the difficulty with which they may be changed. For this reason it is generally believed that it would be better if the code could be under the regulation of a department of the government. It would, in fact have the force of law, but would be more easily changed if modification was deemed desirable.

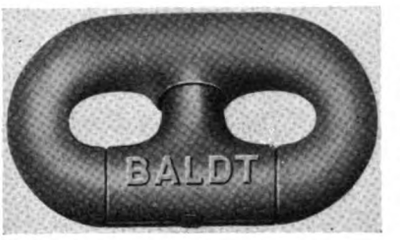
Electric Drive for White Star Liner

ACCORDING to an announcement by Lord Kylsant, chairman of the White Star Line, who arrived in New York on October 23 on the *Majestic*, the new 1000-foot, 60,000-ton liner to be built for the White Star Line by Harland & Wolff, Belfast, Ireland, will be equipped with electric drive. The electricity will be developed by generators driven by either steam turbines or internal combustion engines. Although it is understood that actual construction of this new vessel has already begun, few details have been made public.

Baldt Detachable Link

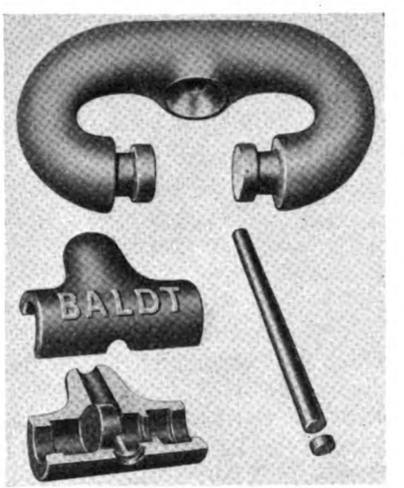
FOR repairing stud-link chain, the Baldt Anchor Chain & Forge Corporation, Chester, Pa., has developed a detachable link that is of the same size as the ordinary chain links, but is more than twice as strong as the ordinary wrought-iron chain. It has an ultimate tensile strength of not less than 125,000 pounds per square inch.

The detachable link is a drop forging made of high-nickel steel. Instead of the link being driven down in dies from flat stock, the ends are bent so as to bring the grain of the metal in the best position to resist stress most effectively. The high-nickel steel, of which the link is made, is in itself a fibrous metal and, after being forged, is heat-treated to increase its strength. Tests show that a link of this type of 1¾-inch diameter will stand a stress of 300,000 pounds. This is more than 50,000 pounds over the breaking stress allowed for cast-steel chain of the same diameter.



Assembled link

The cap is also a drop forging, the only machine work required on the entire link being the drilling of the hole for the taper pin which locks the link. This taper pin is driven into the depth of a recess; later, a lead slug is driven into this recess, securing the pin. The pin can be removed easily by driving from the opposite end and shearing the slug. In all tests of the link it was found, after the breaking stress had been applied, that no strain was put upon the connecting pin as at this point the link could be easily taken apart without any sign of distortion.



Parts of the link

The development of this detachable link makes it possible to discard the old method of connecting chains together by means of enlarged links, end links and shackles which always cause difficulty in riding over the wildcat. This link is the same length as that of every other link in the chain, so that an old or defective link can be removed by burning and the detachable link put in its place without removing the entire shot of chain to a testing plant for inspection. Shots of chain joined by the detachable link will ride easily over the wildcat.

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Questions and Answers for Engineers

Practical information on the operation and maintenance of boilers, engines and auxiliaries

This department is maintained to help those who desire practical information regarding engine room problems or who are preparing to take examinations for a marine engineer's license. Readers are urged to send in questions. Inquiries bearing the name and address of the writer will be answered promptly by mail. If the question is of general interest the answer will also be published in an early issue of the magazine, although the identity of the writer will not be disclosed in doing so. Anonymous communications will not be considered.

Why Is a Governor Required?

Q.—What is the object of placing a governor on an engine?

A.—To maintain regularity of speed of an engine when the load is varied from any cause.

Flexible Coupling Between Turbine and Gear

Q.—Explain why a flexible shaft and coupling is used between the pinion and shaft and the turbine spindle shaft.

A.—In order to permit of movement of the floating frame carrying the pinion bearings, it is necessary to introduce a flexible coupling between the turbines and gear. Additional flexibility to that provided by the flexible coupling may be obtained by the use of a flexible shaft inside the pinion shaft. The actual use of these two units in any installation is to take care of misalinement.

Governor on Turbine Circulator

Q.—How does a governor work on a turbine circulator? If it should trip, what must be done before the pump can be started again?

A.—The emergency or trip governor is usually set to operate at a speed of about 10 percent higher than the rated speed of the turbine. One representative type is fitted on the end of the turbine shaft and consists of a disk, held in position by a spring, pivoted about a stud and limited in its movement by a pin directly opposite the first pin. This stop-pin passes through an elongated hole in the disk. When a certain speed is reached, centrifugal force overbalances the spring pressure and the disk moves outward, striking a trigger which in turn releases a latch lever. The released latch lever is now pulled over by means of an attached spring causing a butterfly valve in the steam-supply connection to close, thus shutting down the turbine. A set screw is provided which can be so set as to prevent the valve from entirely closing, thus permitting the pump to run at part speed after the emergency governor operates, if so desired. The trip valve may be reset, either by a handle attached to the latch lever or by pulling the same rod that tripped the valve. When the turbine has reached a sufficiently low speed to permit the disk to return to its normal position, the gear may be reset.

Turbine Blades

Q.—What kind of blades are used in the General Electric, Fletcher and Westinghouse turbines?

A.—The General Electric Company blades are of the impulse type throughout the ahead and astern turbines.

The Fletcher turbines have impulse blades in the high-pressure end and reaction blades from there on down. Impulse blades are fitted in the astern turbine.

The Westinghouse Company, for turbines up to 200 kilowatts capacity, use the re-entry impulse system. In the larger machines, a combination of impulse and reaction blades is used as in the Fletcher turbine. The astern blades are of the impulse type.

Stages of an Air Ejector

Q.—What are the first and second stages of an air ejector and which is opened first?

A.—This arrangement consists of two steam ejectors working in series. The upper ejector is called the first stage and the lower the second stage. The first stage draws air and vapor from the condenser. This mixture of air, vapor and steam enters a diverging nozzle called the diffuser or second-stage steam chest. Steam from the second-stage nozzles draws the mixture from the second-stage steam chest or chamber from where it is discharged either to the atmosphere or through the air separator to the feed tank. In starting up the apparatus the first-stage steam cut-out valve should be closed and the main steam valve opened wide. This by-passes the first-stage nozzles and permits raising the vacuum in a shorter time. When the vacuum reaches about 25 inches, it opens wide the first-stage cut-out valve. The apparatus is now in full operation.

Kingsbury Thrust Bearing

Q.—Describe the Kingsbury thrust bearing and tell where they are generally placed on a Westinghouse cross-compound turbine?

A.—The Kingsbury thrust bearing consists of a collar as a part of, or secured to, the shaft end by means of a nut. The thrust shoes are in segments having babbitted faces and fitted on the back with a spherically-faced, hardened-steel button. These buttons rest against rings on either side of the collar which are held firmly against the casing or in an adjustable cage. The seats or buttons are so located as to permit the shoes to adjust themselves to give a greater opening for the oil on the supply side and thus secure the desired wedge-shaped action. This gliding or skimming over a film of oil which adheres to and moves with the collar allows a much higher thrust load to be carried than is the case with the orthodox type of thrust bearing.

In marine service the thrust bearing is fitted to the forward side of the reduction gear on the shaft extended, carrying the main gear wheel.

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Duty of the Reduction Gear

Q.—What is the duty of the reduction gear and how often should it be examined?

A.—By the use of a reduction gear, it is possible to design the turbine to operate at a high speed thus decreasing its steam consumption, space occupied, and weight, while at the same time the pump or propeller to be driven may be designed on a revolution basis best suited for maximum efficiency. The condition of the tooth faces and oil-spray nozzles should be inspected at least once a week.

Air Separator

Q.—Describe an air separator and tell why it is necessary in connection with the air ejector.

A.—One form of air separator consists of a cast-iron tank or chamber. The lower half has a vertical baffle on one side of which the condensate inlet from the condensate pump and the steam and air from the air ejector enter. This mixture passes up and over the baffle and out from the other compartment. The upper portion is fitted with tubes through which cooling water circulates. Air and vapor, rising from the lower half of the tank, pass up between the tubes; the vapor is condensed, the condensate drops back into the lower chamber and the free air passes out through a vent at the top to the atmosphere. The object of this separator is to prevent air drawn from the condenser from going back into the feed system.

Dummy Piston

Q.—Describe a dummy piston and tell what it is for?

A.—In Parsons turbines in addition to the steam thrust on blading there is on the annular surfaces exposed to unbalanced axial pressure an end thrust both of which may become balanced by the use of a dummy piston. The dummy piston is an extension of the high-pressure end of the drum. Outside and concentric with this piston is the dummy casing which is a part of the turbine casing. Alternate rings of labyrinth packing are fitted on the piston and cylinder which have a very small running clearance. The steam leaking through the labyrinth is wire-drawn down to some desired pressure as it passes through the last or forward row. A part of this steam leaks out through the labyrinth packing around the shaft and the remainder is piped off to the after end of the turbine or condenser. Through the use of this "equalizing pipe," connecting the two ends of the turbine, the pressure which exists at the last row of turbine blades acts on the net area of the after end of the turbine and balances the thrust on the forward end.

Floating Frame of Westinghouse Reduction Gear

Q.—Explain the floating frame on the flexible beam of the high-speed pinion of the Westinghouse reduction gear.

A.—To describe fully the floating frame with its operation would require more space than this column allows. Briefly, it may be stated that on the lower side of the frame, carrying the pinion-shaft bearing, cylinders are located with pistons resting on a suitable beam or ledge in the gear casing, while another set of cylinders is fitted in the upper side of the pinion frame to take the thrust when the direction of motion is reversed. There are passages connecting all cylinders. These pistons, when a fluid pressure is exerted on them, will cause the pinion frame to rise or, in other words, it will float on the fluid contained in the cylinders. The lift of the pinion frame, operating a relief valve on the fluid side of the pressure system, maintains a pressure in direct ratio to the load on the floating frame. When the rotation of the piston is such as to cause a downward thrust on the floating frame the relief valve maintains a pressure in the cylinders sufficient to balance the weight of the floating frame, plus the downward thrust due to pressure between the pinion and gear teeth. Should the load be increased on the gear teeth, the pinion frame will be slightly depressed, causing the relief to close to the point where equilibrium will be restored. The fluid pressure in the system is maintained by taking advantage of the fact that, if oil is introduced into a rotating journal at the point of least pressure and a point of discharge is provided at the point of maximum pressure, the journal will have a pumping action and build up an oil pressure approximately equal to the maximum bearing pressure.

Reassembling Gears and Casings in Turbine Installation

Q.—What care and precautions should be taken in reassembling a set of gears and casings in a turbine installation?

A.—(1) Make sure that all tackle, chain fall, slings, eye bolts, etc., are in first-class condition.

(2) Should a bearing have excessive clearance, replace it with a spare, or rebabbitt and carefully fit it. When reinstalling, be careful to preserve the alinement.

(3) Should the bearing surfaces of the thrust-bearing collar become scratched, restore the surfaces by the use of a very smooth oil-stone and kerosene. See that the babbitt surfaces of the bearing rings are free from ridges and burrs.

(4) Clean and dry all journal and joint surfaces, and the interior of the casing, before reassembling, and remove all tools, etc. The engineer must personally inspect to see that no loose material, such as tools, bolts, nuts, blocking, clothing, etc., has been left in the casing.

(5) Before connecting the turbine and pinion shaft, check the alinement and make any necessary connections.

(6) Thoroughly clean all oil passages in the casing. the oil pipes, oil manifolds, oil nozzles and the oil-distribution system by blowing them out with steam.

(7) Clean the circular oil grooves on the outside of the bearing shells, as well as the oil inlets and outlets.

(8) See that the bearing shells sit tightly in position, to avoid loss of oil pressure.

(9) Before replacing the pinions and gears, examine them for damaged teeth, loose gear disks, pitting and cutting of the journals. Remove any burrs on the pinion or gear teeth with a smooth file. Polish the shaft journals, if necessary, with a fine oil-stone. Rust will form unless gears, journals, etc., are wiped dry before oil is applied.

(10) Note the thrust-bearing clearance and make the necessary adjustments.

(11) Check the alinement and clearances of the whole gear train and make a clear record of all adjustments and clearances.

(12) The joint surfaces of the couplings must be free from burrs and dirt. The faces must be square before being bolted together. Use new cotter or split pins where necessary.

(13) Carefully clean the joints of the casing to prevent oil leakage.

(14) All bolts and nuts must be set up tight. Replace all locking devices on rotating and stationary parts.

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Questions and Answers Relating to Ship Design and Construction

By J. L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Criticism of a Tanker Design

Q.—Please give your opinion regarding the following proportions, etc., of a motor tank vessel in which easy driving and ability to maintain sea speed are of more importance than maximum cargo capacity:

Length between perpendiculars, 430 feet; length, load waterline (cruiser stern), 440 feet 6 inches; breadth, 54 feet; depth, to main deck, 31 feet; designed load draft, 26 feet; block coefficient, 0.763; longitudinal coefficient, 0.785; midsection coefficient, 0.971; load waterplane cofficient, 0.826; length parallel middle body, approximately 138 feet (32 percent). Ship has poop 117 feet long; forecastle, 50 feet long and no amidship bridge erection, this being aft above forward end of poop. Hull constructed with two longitudinal bulkheads, each 10 feet 6 inches out from centerline, and transverse bulkheads, 22 feet 6 inches apart, forming 11 tanks of three compartments each. The longitudinal bulkheads extend 7 feet 6 inches above the main deck and form a continuous trunkway from the forecastle to the poop.

What is your opinion of the stability of this ship at load draft and with cargo loaded to within two or three feet of the top of the trunk? What is your estimate of the height of the metacenter and center of gravity above the base and the frictional and residuary horsepower for 11 knots?

A.—The questions which you have proposed are pertinent to tanker design and therefore of genuine interest, but satisfactory answers require more information as to character of service and general arrangement of ship than has been furnished. Further, they involve more extensive consideration of the subject than is ordinarily felt to lie within the scope of this department. Accordingly, the following discussion is somewhat general in nature and based upon assumptions where necessary. It cannot be taken as an authoritative criticism.

You have requested—

(a) An opinion relative to the proportions proposed for the ship.

(b) An opinion relative to the stability of the ship in two conditions of loading.

(c) An estimate of frictional and residuary horsepower for a speed of 11 knots.

For reasons which will be apparent later in the discussion, an approximation to the weights of your proposed ship and to those of two other ships meeting the same requirements as to capacity and displacements as your design have been prepared and are tabulated below:

	(1)	(2)	(3)
Length on waterline, feet	440.5	427	420
Length between perpendiculars, feet	430	417	410
Beam, feet	54	55.7	57
Depth, feet	31	29.6	29
Weight of hull steel, including rivets	3,148	3,040	3,008
Weight of wood, paint and cement	155	150	148
Weight of systems and outfit	430	430	430
Weight of propelling machinery and power plant	600	600	600
Weight, ship light	4,333	4,220	4,186
Weight of complement, stores and fresh water	100	100	100
Weight of bunker oil	335	335	335
Weight of cargo oil	8,732	8,845	8,879
Total deadweight	9,167	9,280	9,314
Load displacement	13,500	13,500	13,500

Note: All the above weights are in long tons. Note also that in calculating displacement it has been assumed that the coefficients apply to the length on waterline, as the vessel is of the cruiser stern type.

You contemplate an unusually close spacing of transverse bulkheads. For main tanks, Lloyd's Register limits the length to 30 feet. The American Bureau of shipping permits 32 feet. The 22-foot 6-inch spacing which you suggest involves three more bulkheads than the American Bureau requires. This feature, together with the second longitudinal bulkhead results in appreciably more weight and cost of construction, which could be justified only by the securing of unquestioned advantages.

The tankage which you contemplate includes a volume of approximately

$$22.5 \times 11 \times 31.3 \times 54. \times 0.99 \times 0.95 = 392{,}500 \text{ cubic feet}$$

up to the main deck level.

The trunk, if filled to a level of 5 feet above the mean main deck level, will provide an additional capacity of

$$22.5 \times 11 \times 21 \times 5 \times .95 = 24{,}700 \text{ cubic feet}$$

The cargo tanks contemplated have a capacity in tons as follows:

To main deck—Light oil (50 cubic feet per ton)	7,850 tons
To main deck—Heavy oil (39 cubic feet per ton)	10,050 tons
To 5 feet above main deck—Light oil (50 cubic feet per ton)	8,340 tons
To 5 feet above main deck—Heavy oil (39 cubic feet per ton)	10,680 tons

The length of cargo-oil space, 247.5 feet, is 57.4 percent of the length between perpendiculars of your design. It is 60.2 percent of the length between perpendiculars of design No. 3. These are rather longer than usual. The percentages of length between perpendiculars are usually between 52 and 56. However, it is necessary before accepting any length finally to check it for trim. In case the tankage as proposed extends too far forward to make possible satisfactory trim when loading with light oils, an entire rearrangement and possibly a reduction in space may be required.

Using Scheme (1) as the basis, an approximation to the height of the center of gravity above the base follows:

	Weight	Vert. lever	Moment
Hull steel	3,148	18.3	57,600
Wood, paint and cement	155	25	3,870
Systems and outfit	430	25	10,750
Propelling machinery and power plant	600	17	10,200
Ship, light	4,333	79.0	82,420
Complement, stores, fresh water	100	15	1,500
Bunker oil	335	17	5,700
Cargo oil	8,732	16.5	144,000
	13,500	17.3	233,620

Note: The above assumes cargo to just reach the main deck level and allows for the effect of free surface.

Let it now be assumed that the cargo oil fills the main holds and stands 5 feet above the mean main-deck level in the expansion trunk. Let it also be assumed that the oil is of such weight that the vessel draws 26 feet as before. The center of gravity of the cargo oil is one foot higher than in the previous condition. The center of gravity of the ship loaded will then be 18 instead of 17.3 feet above the base.

The position of the transverse metacenter will be the same in each of the two cases just described and may be approximated as follows:

$$KM = BM \text{ plus } KB \text{ in which}$$

$$BM = \frac{\alpha LB^3}{V} \text{ and}$$

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$$KB = H - \frac{1}{3}\left(\frac{H}{2} + \frac{V}{A}\right)$$

In the foregoing—

KM = Distance from keel to transverse metacenter
BM = Distance from center of buoyancy to transverse metacenter
KB = Distance from keel to center of buoyancy
L = Length on waterline
B = Beam on waterline
α = the inertia coefficient for the water plane in question
H = the mean draft
V = the displacement in cubic feet
A = the area of water plane in square feet.

For the water plane suggested the value of α should be about 0.07 and A should have a value of about 19,650 square feet.

Then KM = 10.2 + 13.7 = 23.9

Then in the first condition the metacentric height is 6.6 feet and in the second 5.9 feet. These are satisfactory. However, it is suggested that the depth proposed be considered further. It is noticeably less in this respect than practice for both ordinary and trunk-deck tankers of similar length with which I have compared it. For the reason just noted, the draft-depth ratio appears too high.

Attention is now invited to the two additional schemes Nos. 2 and 3, shown in the weight tabulation in the early part of the present discussion. These schemes are shorter and wider than your scheme marked No. 1. The principal form characteristics of the three schemes are tabulated below:

	(1)	(2)	(3)
Length on waterline, feet	440.5	427	420
Beam, feet	54	55.7	57
Draft, feet	26	26	26
Displacement, tons	13,500	13,500	13,500
Displacement—length coefficient	158	173.5	182.5
Prismatic coefficient	0.785	0.785	0.774
Mid-section coefficient	0.971	0.971	0.98
Beam ÷ draft	2.08	2.14	2.19
Length ÷ Depth	14.2	14.4	14.5
At a speed of 11 knots			
Estimated frictional effective horsepower	958	942	935
Estimated residual effective horsepower	352	348	345
Estimated total effective horsepower	1310	1290	1280
Assumed value of propulsive coefficient	0.55	0.55	0.55
Estimated shaft horsepower	2380	2350	2330
Maximum or designed indicated horsepower	2850	2820	2800

Scheme 2 was laid out to give the same value of the prismatic coefficient as that of Scheme 1, but on shorter length.

Scheme 3 was intended still further to decrease the length, increase the beam, and at the same time reduce the value of the prismatic coefficient.

For comparative purposes both Schemes 2 and 3 have been given proportionally small depths.

Note that both Schemes 2 and 3 can be driven on approximately the same horsepower at the designed speed, 11 knots, as Scheme 1.

Note also that Schemes 2 and 3 require somewhat less weight of hull steel than Scheme 1 and each carries slightly more deadweight than Scheme 1.

Scheme 3 in particular is much more representative of the present tanker practice as regards the relationship of displacement to length and beam to length than Scheme 1. Unless some important advantage is to be gained by a departure from practice without incurring any serious disadvantage, the writer considers it good judgment to adhere to what experience has shown to satisfy service demands.

Relative to the length of parallel middle body which you suggest, 32 percent, Mr. E. M. Bragg in Sterling's "Marine Engineers' Hand Book" suggests 30 to 32 percent for the conditions which you are meeting. The parallel middle body, however, should not be placed symmetrically about the vessel's half-length but about 2/3 of it should be forward and 1/3 aft the half-length.

Relative to the figures given for horsepower, values for residual and frictional power have been included as requested. These have been calculated from data given in Admiral D. W. Taylor's "Speed and Power of Ships." It is thought that the figures for residual may be too large and those for frictional resistance correspondingly too small. The total effective horsepowers are reasonable.

As a check upon the effective horsepower given in the table, calculations based upon data given by Bragg have been made for each of the three schemes. These results indicate that an indicated horsepower of 2900 to 2950 could wisely be accepted for any of the three schemes.

Communications

Correction to "Method for Solving Continuous Beams"

HADDONFIELD, N. J.

TO THE EDITOR:

In the first example given in the article on "Method for Solving Continuous Beams" published on page 494 of the September issue, the equation near the upper right-hand corner of page 498 should have read:

$$R_a = (1000 \times 0.7) + (2000 \times 0.2) + (5000 \times 0.5) - (3030 \times 0.3) - (2830 \times 0.6) = 993 \text{ pounds.}$$

Otherwise, this example, including the results, is correct.

The second example, which obviously should have been worked by Fig. 3, page 497, was inadvertantly worked using Fig. 1, page 495, with, of course, erroneous results. The correct solution follows:

The deflection at B is,

Due to P_1 (at 0.70, due to load at 0.80) = 0.00189 × 500.
Due to P_2 (at 0.30, due to load at 0.65) = 0.00231 × 5000.
Due to R_b (at 0.70, due to load at 0.70) = 0.00308 × R_b.
So. $R_b = (0.00189 \times 500) + (0.00231 \times 5000) \div 0.00308 =$ 4060 pounds.

Using the formula for end reaction given in Fig. 3,

$$R_a = (500 \times 0.80^2 \times 1.4) + (5000 \times 0.35^2 \times 2.30) - (4960 \times 0.70^2 \times 1.60) = -1330 \text{ pounds.}$$

(Notice that R_a is a downward reaction.)

Similarly, R_c = 2770 pounds.

Bending moments (in inch-pounds):

$$M_a = -(500 \times 0.20 \times 0.80^2 \times 100) - (5000 \times 0.65 \times 0.35^2 \times 100) + (4060 \times 0.30 \times 0.70^2 \times 100) = +13470$$

(positive moment, beam is concave upwards).

$$M_c = -(500 \times 0.80 \times 0.20^2 \times 100) - (5000 \times 0.35 \times 0.65^2 \times 100) + (4060 \times 0.70 \times 0.30^2 \times 100) = -49960$$

(negative moment, beam is concave downwards).

The moments at P_2, B and P_1 are obtained by summation of moments at either right or left, as follows:

$M_{P2} = (-49960) + (2770 \times 35) = +46990$
or $= (+13470) - (1330 \times 65) - (500 \times 45) + (4060 \times 35) = +46620$
Mean = +46805

The discrepancy results from, and indicates the magnitude of, the error in the interior reaction as discussed at the end of the first example.

$M_b = (-49960) + (2770 \times 70) - (5000 \times 35) = -31060$
or $= (13470) - (1330 \times 30) - (500 \times 10) = -31430$
Mean = −31245
$M_{P1} = (-49960) + (2770 \times 80) - (5000 \times 45) - (4060 \times 10) = -12760$
or $(13470) - (1330 \times 20) = -13130$
Mean = −12045

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A comparison of these values with those obtained by direct calculation follows:

	From Charts	Calculated
R_b	+ 4060 pounds	+ 4057 pounds
R_a	— 1331 pounds	— 1324 pounds
R_c	+ 2770 pounds	+ 2767 pounds
M_a	+ 13470 inch-pounds	+ 13430 inch-pounds
M_c	— 49960 inch-pounds	— 49980 inch-pounds
M_b	— 31245 inch pounds	— 31229 inch-pounds
Mp_2	+ 46805 inch-pounds	+ 46865 inch-pounds
Mp_1	— 12045 inch-pounds	— 13050 inch-pounds

John P. Comstock.

Questions and Answers

Cleveland, O.

To the Editor:

Permit me to reply to the very courteous expressions of Mr. Charles J. Mason relative to my utterances in the August issue, for which I desire to thank him.

Evidently I had not quite "made" my point, with him, in regard to the question and answer method (?) of instruction, concerning which I have expressed myself very unfavorably, and I confess that it is difficult for me to speak impassionately on the subject, when I reflect on the fact that this has been a most fruitful field for entirely incompetent instructors to capitalize their own inadequate knowledge in the exploitation of unsophisticated sailor boys, who will accept almost any statement on a technical subject, uninquiringly, and pay generously for it, provided it is in more or less imposingly printed form.

Why are questions and answers at all in demand? It seems to me that those in quest of such information usually intend ultimately to try the examination before the Steamboat Inspectors and they are in hopes thus to receive the very questions they will be asked in the examination and brief answers thereto. In most cases, the main concern is just to "get by" in the examination rather than to obtain a comprehensive understanding of a subject with which familiarity is essential to safe operating under a license. Some men actually do know the subject, but find it hard to convince an examiner of the fact, because they have not the gift of expression, and, hence, welcome a sample of how others do it.

There are some few most important points on which the examiners insist that every candidate prove his thorough knowledge, but most of the questions are taken at random to test the candidate's grip on subject matter many times as extensive as the number and character of questions would lead one to believe. To examine a candidate on absolutely everything he is supposed to know is obviously out of the question and, if the candidate knows only enough to "get by" and is satisfied with that, he does not meet the demands of the service in which he expects to hold a responsible position, even if he is licensed by a streak of good luck.

Questions should serve more as a means to test knowledge than as a lazy man's easy way to obtain information. Frequently the greatest possible harm can be done a questioner by directly answering him, rather by propounding a counter-question or giving just hint enough to enable the inquirer to find his own answer, without being offended or without losing confidence in the one looked to for help.

We are all conscious of the fact that much information must be exchanged through questions and answers, especially in the realm of ascertaining facts, and remembering them, without any opportunity for reasoning. For instance, there are no laws, no fundamentals, from which to reason out the character of range lights in a certain port or the data on an inspection certificate. But, teaching engineering to students is quite another matter.

Engineers must first of all learn to think for themselves. In the making they are as human as other folks and will gladly let someone else do the arduous brain work for them, and accept the result, but their own "thinking machinery" cannot so develop and develop it must.

I wish I could sit down with Mr. Mason and discuss some of the much recommended catechisms and lesson sheets of certain schools, most of whose courses (?) I have critically examined, and show him instances galore for my condemning the methods under discussion.

The very fact that men turn to catechisms and question and answer courses (?) is proof conclusive that they wish to sidestep painstaking mental processes by which alone mastery of a subject can be attained. They want something "short and sweet" and mighty few important principles can be thus imparted. Hence, they get into the way of becoming satisfied with a most superficial solution to any problem, which is essentially bad, and the very men catering to such demand hide their own ignorance behind the expected brevity. That is, indeed, a trade secret, freely "worked" by those who are trying to make money by such means of instruction. As teachers, they are usually dictatorial, permit no discussion of their statements, no challenge of their explanations. Their intolerant "the-answer-is" attitude does not make men; it breaks them, so that they do not know, nor trust, their own minds. Instead of putting a premium on independent initiative and mental daring, they develop men who never dare to do or say anything unless someone has previously shown them or told them.

It is, of course, an entirely erroneous idea that a young man in pursuit of learning, but unable to attend the higher schools of learning, has only catechisms and correspondence schools to resort to. Almost every library has able men and women competent and willing to advise (often printed study outlines are prepared on subjects of interest in the various trades) on reliable books readily understood by men of limited schooling. Some of our very best engineers are not college men, nor correspondence school products, nor catechism exponents; they are just real men, whom some kind agencies taught to help themselves.

Nor is it true that information gained through these catechisms and questions and answers handed out promiscuously by rather incompetent men and presuming to cover a subject, of which they do not even effectively scratch the surface, is better than nothing at all, as Mr. Mason claims.

After conscientiously striving for fourteen winters to give real aid to ambitious sailor boys aspiring to officers' berths, I have found that those who have relied on such instruction simply "got nowhere" and, worse than that, had definitely lost most of their open-mindedness, so that I had to blast a lot of stumps of inaccurate and some downright false instruction, before I could start in to plow their fertile brains. A little knowledge is a dangerous thing.

To be sure there are some reputable correspondence schools, conducted by men of recognized training and ability, but these substantiate their teaching with due authority and give the references of their sources of information, as do those able men who answer questions sent in to high-grade periodicals on isolated subjects.

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However, worth-while courses of instruction for American sailor men, able to think, but in need of being frequently reminded of that fact, must not be administered in ways effective only for parrot training.

It is decidedly bad to tear down something men lean on, without offering them something better and I hope that the publishers of this paper will presently allow me to present a feasible study outline for those aspiring to an engineer's license. In the mean time, as far as my time and strength permits, I will gladly help any inquiring man to map out a study program for himself, if he will tell me what has been his training and experience to date, and I shall do that without any charge.

I am for any young man trying to get ahead, and for any man or agency honestly striving to help such men; but I am against grafters and ineffectual methods.

DAVID GAEHR.

New Book

TASCHENBUCH FUR SCHIFFSINGENIEURE UND SEEMASCHINISTEN. By E. Ludwig. Size, 7 by 4 inches. Pages, 576. Illustrations, 495. Munchen and Berlin, 1928: R. Oldenbourg. Cloth binding.

This is a handbook written in the German language prepared for marine engineers and ship mechanics. There are chapters devoted to mathematics, simple mechanics and physics. Others deal with the reciprocating engine, propellers, condensers, turbines, Diesel engines, boilers, pumps and auxiliaries. The application of electricity on shipboard is discussed. This volume contains the essential technical information required by an engineer on shipboard.

Personal

J. S. Gade has recently resigned as port captain for **Swayne & Hoyt, Inc.**, San Francisco, Cal., in order to devote more time to the business of the **San Francisco Stevedoring Company.**

Captain Herman Parker, formerly local inspector of steamboats at Boston, has been appointed assistant marine superintendent of the **Eastern Steamship Lines,** Boston, Mass.

Captain Charles Lyons, formerly assistant inspector of hulls in the **United States Steamboat Inspection Service** at Boston, Mass., has been promoted to the position of local inspector of steamboats.

Captain Theodore G. Lewton, United States Coast Guard, has assumed the post of chief engineer of the California division. Captain Lewton succeeds **Captain John E. Dorry** who was retired September 26.

W. Earl Bryan, formerly connected with the **Jones & Laughlin Steel Corporation,** has been appointed assistant boiler inspector in the offices of the United States Steamboat Inspection Service at Pittsburgh, Pa.

Henry F. Gelhaus, formerly superintending engineer for **Swayne & Hoyt, Inc.,** San Francisco, Cal., has been promoted to the position of marine superintendent of that line.

H. W. Ordeman, formerly in charge of Pier 86, North River, New York city, for the **United States Lines** before the lease was turned over to the **Hamburg American Line,** has opened an office in the Federal Trust Company Building, Newark, N. J., as a civil engineer to do consulting and supervision work.

Frank J. O'Connor of San Francisco, Cal., has been elected president of the **Ship Owners' Association** of the Pacific Coast for the sixth successive time. **R. W. Myers** and **James U. MacLafferty** were elected vice-presidents, and **Nat Levin** was re-elected secretary and treasurer.

Sir Westcott Abell, former chief surveyor of **Lloyd's Register of Shipping,** London, has been appointed to the chair of naval architecture of **Armstrong College,** Newcastle-upon-Tyne, as a successor to Dr. J. J. Welch, who will retire at the end of September. Sir Westcott was educated at the Royal Naval Engineering College, Keyham, and the Royal Naval College, Greenwich, and after serving some time in the Royal Corps of Naval Constructors and as professional secretary to the Director of Naval Construction he returned to Greenwich as instructor in naval architecture, which position he held from 1907 to 1910. From 1910 to 1914 he occupied the chair of naval architecture at Liverpool University, and during that period began his work on the Board of Trade load line committee. In 1914 Sir Westcott was appointed chief ship surveyor to Lloyd's Register of Shipping, which office he continued to hold until the early part of the present year, when he retired to take up private consulting practice.

Obituary

Chauncey G. Whiton, marine superintendent of the **Hudson River Day Line,** Desbrosses street, New York city, died on Saturday, September 29, at his home in Jackson Heights, Long Island.

Mr. Whiton was born in Hingham, Mass., on February 17, 1872. He received his education in the public schools of the town and at the Massachusetts Institute of Technology, Cambridge, Mass., where he specialized in marine engineering and naval architecture. After leaving college he entered the employment of the New Bedford, Martha's Vineyard and Nantucket Steamboat Company. He was later made treasurer and general manager of the company, which position he held till 1916. For the next two years he was president of the New Bedford Towboat Company, resigning that position to become marine superintendent of the Hudson River Day Line, New York, which position he held at the time of his death. He was a life member of the Boston Young Mens Christian Union, a director of the National Board of Steam Navigation, a member of the Society of Naval Architects and Marine Engineers, the Propeller Club of the United States and the Empire State Society, Sons of the American Revolution.

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Ship Construction and Repair News

Proposed work—Bids asked—Bids received—Contracts awarded—Current activities

Night Line Asks Bids for Constructing Two Vessels

PLANS and specifications for two Diesel-propelled vessels for the Hudson River Night Line, New York city, have been completed and issued to the shipyards for bids. Tenders for this work will be received in the offices of Henry J. Gielow, Inc., New York city, designers of the vessels, shortly.

The proposed ships will have a length of 325 feet, a beam of 58 feet, and a depth of 23 feet. They will each be of twin-screw propulsion, each screw being driven by a Diesel engine of approximately 1600 horsepower. These vessels will be used primarily for the transportation of motor trucks and automobiles.

Plans for Ward Line Ships Nearing Completion

WORK on plans and specifications for two passenger vessels for the New York & Cuba Mail Steamship Company (Ward Line), Wall street, New York city, are rapidly nearing completion at the offices of Theodore E. Ferris, naval architect, 30 Church street, New York city. It is believed that the plans will be approved by the Shipping Board and Navy Department and issued to shipyards for bids early in November.

The vessels will have a length overall of 508 feet; beam 59.8 feet; draft 26 feet; displacement 15,750 tons; gross tonnage 11,300, and net tonnage 5700. They will be twin-screw vessels and will be driven at a speed in excess of 18 knots by single-reduction geared turbines. Accommodations will be provided for 378 first-class and 90 second-class passengers. A crew of about 200 will be carried.

Contract for Five Derrick Lighters Awarded by Erie R.R.

A CONTRACT for the construction of five derrick lighters was recently awarded to Ira S. Bushey & Sons, Brooklyn, N. Y., by the Erie Railroad, 50 Church street, New York city. Bids for the work were opened privately on August 1. The price involved was not given out.

The derrick lighters will have a length of 72 feet, a beam outside of planking 30 feet, and a depth of 9 feet. This project is in conjunction with the Erie Railroad's $27,000,000 improvement plan that was announced some time ago.

Contract for Two Barges

THE Anderson-Tully Company, Memphis, Tenn., recently awarded a contract for the construction of two barges to the American Bridge Company, Ambridge, Pa. The price involved was not made public.

First Construction Loan for Overseas Shipping

A LOAN amounting to three-fourths the cost of building four passenger and cargo vessels for operation between New York and Mediterranean ports was granted the Export Steamship Corporation of New York city by the Shipping Board on October 23. This is the first such loan to be concluded from the Shipping Board's Construction Loan Fund in aid of building tonnage for overseas foreign trade as provided by the Merchant Marine Act of 1928.

Plans for Four Export Line Vessels Issued to Prospective Bidders

PLANS and specifications for the construction of four passenger and cargo vessels for the Export Steamship Corporation, 25 Broadway, New York city, were issued on September 28 to prospective bidders, and tenders will be received at the office of the Corporation on Monday, November 5. The vessels will have a length between perpendiculars of 450 feet; a breadth of 61 feet 6 inches; depth, molded to second deck, 33 feet 3 inches; depth, molded to shelter deck, 42 feet 3 inches and a deadweight of 9500 tons. They will be of steel construction with a raked stem, double-knuckle stern, and two complete decks. The ships are for operation between North Atlantic ports of the United States and ports in the Mediterranean.

The propelling machinery will consist of one set of three-unit triple-expansion, condensing turbines, developing 6300 shaft horsepower, and operating a single propeller through reduction gearing. Steam will be supplied at 325 pounds per square inch working pressure and 150 degrees superheat by four oil-fired water-tube boilers. The speed of the vessels in service in load condition will be 14 knots.

Each of the ships will be equipped with a streamline rudder.

They will be built according to the highest class of the American Bureau of Shipping and the United States Steamboat Inspection Service.

The vessels will be built under the construction loan feature of the Merchant Marine Act of 1928 and will comply with the requirements of the Navy Department, for naval auxiliaries, and the Postoffice Department which has awarded a mail contract to the Export Corporation. When the contract for these vessels is placed, all the features of the Merchant Marine Act will have been complied with.

The ships were designed by George G. Sharp, 30 Church street, New York city, in association with James Donald.

Shipping Board Awards Contracts for Installing Diesel Engines in Six Vessels

THE United States Shipping Board, Washington, D. C., awarded contracts recently for the installation of Diesel engines in six government-owned ships. Bids for the work were originally received on August 21, but were rejected as too high. The specifications were revised and new tenders received October 2. The following awards were made:

Federal Shipbuilding Company, Kearny, N. J., installation of Hooven-Owens-Rentschler engines in the vessels *New Orleans* and *Wichita*, for $1,132,900.

Maryland Drydock Company, Baltimore, Md., who was awarded the contract for Dieselizing the *Galveston* and *Oldham* under the original invitation of bids for $1,064,368, received the contract for installing Worthington engines in the *Potter* and *Jeff Davis*, for $1,106,885.

Newport News Shipbuilding & Drydock Company, Newport News, Va., installation of Busch-Sulzer engines in the *City of Elwood* and *Ward*, for $1,119,200.

All contracts call for the construction and installation of stream-line rudders in each vessel.

In addition to the amounts stipulated in these contracts, the Shipping Board has authorized its committee on Dieselization to expend not to exceed $15,000 per vessel for contingencies and extras, should any be found necessary during the progress of the work. The board further authorized the committee to expend not to exceed $33,000 per vessel for the purchase and supply of additional and incidental equipment and outfit necessary to fit the six vessels for active service.

Barkentine Yacht To Be Constructed at Lawley Yard

A CONTRACT for the construction of a 206-foot barkentine to be built for Walter P. Murphy of New York city, was recently awarded to the George Lawley & Son Corporation, Neponset, Mass. The vessel will be built of steel and equipped with Diesel engines. She was designed by Arthur B. Raymond, naval architect of Montclair, N. J., and will be completed in about a year's time

Contract for Three-Masted Schooner Placed

A CONTRACT for the construction of a 216-foot three-masted Diesel auxiliary schooner yacht has been awarded to the George Lawley & Son Corporation, Neponset, Mass. The vessel was designed by Henry J. Gielow, Inc., New York city. Further details are not available at the present time.

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Contract Awarded for Construction of Three Lightships

THE Department of Commerce, Bureau of Lightships, Washington, D. C., has awarded a contract for the construction of three lightships to the Charleston Drydock & Machine Company, Charleston, S. C., at a price of $554,766 and a time of 660 days. Bids for the work were received at Washington on September 6.

The lightships will be designated as *Nos. 115, 116,* and *117*. They will have a length overall of 133 feet 3 inches; a length on the waterline of 108 feet 9 inches; a beam of 30 feet; a draft of 12 feet 6 inches, and a displacement of 630 tons. The vessels will be equipped with four 120-horsepower Diesel engines.

Contract Awarded for Inter-Island Steamer Construction

A CONTRACT for the construction of a small steamer for the Inter-Island Steam Navigation Company, Honolulu, T. H., has been awarded to the Union Plant of the Bethlehem Shipbuilding Corporation, Ltd., San Francisco, Cal. This ship will operate in the Hawaiian Islands, carrying passengers and cargo. She will have a length overall of 220 feet, will be of 1200 gross tons registry, and will be propelled by a 1700 shaft horsepower, complete expansion, impulse-reaction turbine, operating at 3600 revolutions per minute. This turbine will drive a single propeller through a single-case, floating-frame reduction gear.

The geared turbine and underneath condenser, which will be located in an after engine room, will be duplicates of the corresponding machinery installed on one shaft of the steamer *Waialeale*, recently built for the Inter-Island Company, except that the gear ratio will be increased to give slower revolutions per minute of the propeller, and the condenser will be placed longitudinally under the turbine instead of athwartships.

The foregoing machinery will be supplied by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. In addition, the Westinghouse Company will furnish two 35-kilowatt geared-turbine direct-current generators for auxliary power and light, forced-draft fan motors, electrical galley equipment, and the stateroom electric fans.

Steam will be generated by two Babcock & Wilcox watertube boilers, operating at 265 pounds gage pressure and 75 degrees superheat.

Bids Asked for Constructing Two Steel Barges

SEALED proposals will be received by the United States Engineer Office, War Department, Wilmington, N. C., until 12 o'clock noon, November 12, for furnishing all labor and materials and performing all work for constructing, testing, and delivering two steel barges. The new barges are to have a length of 60 feet, beam of 22 feet and a depth of 4 feet.

Both barges are to be delivered in good condition, afloat, one at Newbern, N. C., and the other at Wilmington, N. C. The barges will be formally accepted when they have been delivered as specified.

Contract Awarded for Construction of New England Steamship Vessel

A CONTRACT for the construction of one passenger and automobile steamer for the New England Steamship Company, Pier 14. N. R., New York city, has been awarded to the Fore River Plant of the Bethlehem Shipbuilding Corporation, Ltd., Quincy, Mass. The price involved was not made public. Bids for the work were opened October 3.

The new vessel will be similar to the *New Bedford* which was recently completed by the Bethlehem Shipbuilding Corporation, Ltd., Quincy, Mass., with the exception that an extra deck with staterooms will be added and all rooms will be supplied with hot and cold running water.

The steamer will have a length overall, 250 feet; length between perpendiculars, 240 feet; beam, molded, 45 feet; beam, over guards, 60 feet; depth, molded, 16 feet, and draft 10 feet. She will have twin screws, driven by two 4-cylinder triple-expansion engines of 2000 horsepower each. Steam will be supplied by two Babcock & Wilcox boilers. The vessel will have a speed of 14 knots.

Colombian Plans for New Ships To Be Issued When Mail Contract Is Signed

PLANS and specifications for three steamships for the Colombian Steamship Company, Inc., 17 Battery place, New York city, have been practically completed and are only awaiting the award of mail contracts to this company before being issued to shipyards for bids. Since this contract may be signed at any time now, the builders may look for an opportunity to submit their proposals in the very near future.

The new ships are to have an overall length of 402 feet 9 inches; length between perpendiculars of 385 feet; beam of 54 feet 6 inches; depth of 31 feet 6 inches; draft of 24 feet, and a deadweight carrying capacity of 4000 tons. Each vessel will carry about 200 passengers of first and tourist class.

The ships will be propelled by single screws, driven by geared turbines. Steam will be supplied at 300 pounds pressure and 200 degrees superheat by four high-pressure watertube boilers. Oil will be used for fuel.

Contract for Construction of Three Tank Barges Awarded

THE American Barge Line Company, Louisville, Ky., recently awarded a contract to the Riter-Conley Company, Pittsburgh, Pa., for the construction of three tank barges for the Louisville and Owensboro oil trade.

Dravo Co. Awarded Contract for One Steel Barge

THE Kosmos Portland Cement Company, Louisville, Ky., has awarded a contract to the Dravo Contracting Company, Pittsburgh, Pa., for the construction of one steel barge. The price involved was not made public.

Moore Drydock Co. to Construct All-Steel Ferryboat

A CONTRACT for the construction of an all-steel ferryboat was recently awarded to the Moore Drydock Company, Oakland, Cal., by the San Diego and Coronado Ferry Company. The ferryboat, which is to be of Diesel-electric drive, is to be 180 feet long, with a beam of 60 feet, and will have accommodations for 80 automobiles. She will cost $325,000, and the contract calls for delivery next spring. The vessel will operate between San Diego and Coronado, and will replace one of the obsolete ferries.

Steamship Mount Clay Purchased By Dollar Line Will Be Reconditioned

THE former United American Line steamer *Mount Clay,* which has been laid up at the Sparrow's Point plant of the Bethlehem Shipbuilding Corporation, Ltd., Sparrow's Point, Md., for approximately three years, was recently sold to the Dollar Steamship Line, San Francisco, Cal. The *Mount Clay,* formerly the Hamburg-American liner *Prinz Eitel Friederich,* was built at Stettin in 1904. She is a twin-screw vessel of 4706 net tons. The price paid was not given out.

Plans and specifications for alterations and reconditioning on this vessel are now being prepared by Theodore E. Ferris, naval architect, New York city and will probably be issued to shipyards for bids in about two weeks time.

The superstructure and passenger accommodations will be completely revised and the arrangements in general altered to bring the vessel up-to-date. The machinery will be thoroughly overhauled and in some cases new auxiliary equipment will be added. It is believed that the work will involve an expenditure of over $1,000,000.

Orders for Twenty Coal Barges Placed by Crucible Steel Co.

THE Crucible Steel Company, Pittsburgh, Pa., has placed an order with the American Bridge Company, Ambridge, Pa., for the construction of 12 standard coal barges, and a contract for eight barges to the Jones & Laughlin Steel Corporation, Pittsburgh, for the Pittsburgh coal trade. The prices involved were not made public.

Midland Barge Company to Build Four Steel Barges

A CONTRACT for the construction of four steel barges was recently awarded to the Midland Barge Company, Midland, Pa., by the United States Engineer Office, Vicksburg, Miss., at a price of $19,200 and a time of 110 days. Bids for the work were received at Vicksburg on September 20.

Contract for Steel Barge Construction Awarded

THE Ruprecht Sand & Materials Company, St. Louis, Mo., has awarded a contract for the construction of one steel barge to the Dravo Contracting Company, Pittsburgh, Pa. The price involved was not given out.

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Construction and Repair Bids

Shipping Board Receives Bids for Conditioning Liners Monticello and Mount Vernon

TENDERS for reconditioning the former German liners *Mount Vernon* and *Monticello* were recently opened by Captain R. D. Gatewood, manager of the maintenance and repair division of the United States Shipping Board, 45 Broadway, New York city. The bids revealed prices far in excess of the original $12,000,000 estimate of two years ago.

Plans were prepared by Gibbs Brothers, Inc., 1 Broadway, New York city, and the Newport News Shipbuilding & Drydock Company, Newport News, Va. The Gibbs plans provided for reconditioning the ships as cabin or tourist third-class passenger and freight liners, with accommodations for about 618 cabin passengers, 394 tourist third-class, and a crew of 427 men. The Newport News plans provide for 777 cabin passengers in 271 rooms, 352 tourist third-class passengers in 101 staterooms, and a crew of 491 men. The bids submitted were in part as follows:

NEWPORT NEWS PLANS

Propositions	Vessels	Tietjen & Lang	Delivery
(1)—Geared Turbines Scotch Boilers	Mount Vernon	$6,640,000 (630 days)	(May 1, 1930)
	Monticello	$6,980,000 (630 days)	.....
(2)—Turbo-Elect. Scotch Boilers	Mount Vernon	6,897,000 (630 days)	.....
	Monticello	7,100,000 (630 days)	.....
(3)—Geared Turbines Watertube boilers	Mount Vernon	7,383,000 (630 days)	.....
	Monticello	7,800,000 (630 days)	.....
(4)—Turbo-Elect. Watertube boilers	Mount Vernon	7,620,000 (630 days)	.....
	Monticello	7,925,000 (630 days)	.....

GIBBS PLANS

Propositions	Vessels	Tietjen & Lang	Boston Navy Yard
(a)—4 ex. single red. geared turbines 2 gears each shaft watertube boilers	Mount Vernon	$8,880,000 (725 days)	$7,160,465 and 6,827,455
	Monticello	9,280,000 (725 days)	.....
(b)—4 ex. single red. geared turbines 1 gear each shaft Watertube boilers	Mount Vernon	8,720,000 (725 days)	7,134,523 and 6,801,523
	Monticello	9,130,000 (725 days)	.....
(c)—2 sets comp. double Red. Geared Turb. Each Shaft Watertube boilers	Mount Vernon	8,830,000 (725 days)	7,039,113 and 6,706,113
	Monticello	9,658,000 (725 days)	.....
(d)—Turbo-elect. Watertube boilers	Mount Vernon	8,680,000 (725 days)	7,054,269 and 6,721,269
	Monticello	9,097,000 (725 days)	.....
(EA)—4 ex. single red. geared turb. 2 gears each shaft Scotch boilers	Mount Vernon	8,900,000	6,860,455 and 6,527,455
	Monticello	8,576,000 (725 days)	.....
(EB)—4 exp. single red. geared turb. 1 gear each shaft Scotch boilers	Mount Vernon	7,935,000 (725 days)	6,834,523 and 6,501,523
	Monticello	8,427,000 (725 days)	.....
(EC)—2 sets comp. double Red. Geared Turb. Each Shaft Scotch boilers	Mount Vernon	8,150,000 (725 days)	6,739,113 and 6,406,113
	Monticello	8,730,000 (725 days)	.....
(ED)—Turbo. Elect. Scotch boilers	Mount Vernon	7,920,000 (725 days)	6,754,269 and 6,421,269
	Monticello	8,385,000 (725 days)	.....

The Newport News Shipbuilding & Drydock Company, Newport News, Va., submitted a price of $5,850,000 and a time of 530 days for the steamship *Mount Vernon* on proposition (1) of the Newport News plans.

The Morse Drydock & Repair Company, Brooklyn, N. Y., submitted a price of $6,610,000 for the steamship *Mount Vernon* on proposition (c) of the Gibbs plans. For the same work on the steamship *Monticello,* the Sun Shipbuilding & Drydock Company, Chester, Pa., submitted a price of $7,507,500.

The Sun Shipbuilding & Drydock Company, Chester, Pa., submitted a price of $7,822,000 for the steamship *Monticello* on proposition (d) of the Gibbs plan, and the Morse Drydock & Repair Company, Brooklyn, N. Y., $6,660,000 for the same work on the steamship *Mount Vernon.*

The Morse Drydock & Repair Company, Brooklyn, N. Y., submitted a price of $6,405,000 on proposition (EC) of the Gibbs plans for work on the steamship *Mount Vernon,* and the Sun Shipbuilding & Drydock Company, Chester, Pa., $7,734,000 on the steamship *Monticello.*

The Morse Drydock submitted a price of $6,405,000 on the steamship *Mount Vernon* for proposition (ED) of the Gibbs plan, and the Sun Shipbuilding submitted a price of $7,595,000 for the same work on the *Monticello.*

The Bethlehem Shipbuilding & Drydock Company, Bethlehem, Pa., submitted an informal bid of $6,500,000 for each ship on proposition (1) of the Newport News plans, adding $225,000 per ship to proposition (2), $300,000 per ship to proposition (3), and $500,000 per ship to proposition (4).

Bids Received for Construction of Two New York State Ferryboats

PROPOSALS for the construction of two 115-foot Diesel-electric ferryboats for the Manhattan State Hospital, Ward's Island, N. Y., were recently received by Lewis M. Farrington, secretary of the Department of Mental Hygiene, Albany, N. Y., with the following results:

Name	Price
New London Ship & Engine Company Groton, Conn.	$207,000
Crowinshield Shipbuilding Company Fall River, Mass.	238,000
Speddin Shipbuilding Company, Inc. Baltimore, Md.	244,000

The contract has not as yet been awarded.

Contract for S.S. Shreveport Repairs Awarded

THE Cities Service Refining Transport Company, 60 Wall street, New York city, has awarded a contract covering explosion repairs to the 6822 gross-ton steamship *Shreveport* to James Shewan & Sons, Inc., New York city, at a price of $284,000 and a time of 60 continuous running days. The entire amidship section of the vessel is to be repaired. Tenders for the work were recently received in New York city, and four other bids submitted as follows:

Name	Price	Continuous Running Days
Robins Drydock & Repair Company	$272,400	90
Newport News Shipbuilding & Drydock Company	298,000	90
Baltimore Ship Repair Company, Inc.	372,186	140
Morse Drydock & Repair Company	489,300	90

Several prices were submitted on a number of miscellaneous items which were not figured in the totals.

Bids for Three Barges Asked by U. S. Engineers

BIDS were received until 12 o,clock noon, October 22, by the United States Engineer Office, War Department, Wilmington, N. C., for constructing and delivering three steel barges. Two types of barges will be given consideration: Plate steel barges constructed with shell and deck formed of steel plates, and channel steel barges constructed with shell and deck formed of structural steel channels.

Bidders submitted proposals for both types of barge. The three barges will, however, be built of one type, and that type will be selected on which the lowest bid is received. The award will be made for the three barges to one bidder subject to the right reserved in the invitation for bids.

The general dimensions of the new barges are to be as follows:

Length	80 feet
Beam, molded	26 feet
Depth, molded	5 feet
Camber	3 inches in 13 feet

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Bids Received for Towboat Machinery

TENDERS for furnishing the Diesel engines and electrical equipment for installation in a new steel-hull, stern-wheel, Diesel-electric towboat were recently received by the United States Engineer Office, Chattanooga, Tenn., with the following results:

Name	Price (2 Engines)
Fairbanks-Morse Company	$34,984
Lombard Governor Company	43,473
Winton Engine Company	46,989
Chicago Pneumatic Tool Company	47,076
Standard Motor Construction Company	51,867
Worthington Pump & Machinery Corporation	52,393
Bethlehem Steel Company	53,519
Fulton Iron Works	54,254

The Fairbanks-Morse Company has been recommended for the award. The plans and specifications for the proposed towboat have not been completed and no date has been fixed for the receipt of bids.

Trawler Sea Hawk Repair Bids

TENDERS were recently received at the offices of Smith & Anderson, 215 Front street, New York city, covering repairs to the trawler *Sea Hawk*, with the following results:

Name	Price	Days
Bethlehem Shipbuilding Corporation, Ltd.	$54,000	40
Atlantic Basin Iron Works Corporation	54,000	40
Todd Drydock, Engineering & Repair Corp.	60,000	40
Tietjen & Lang Drydock Company	63,000	42
W. & A. Fletcher Company	64,000	60
Morse Drydock & Repair Company	65,604	65
Federal Shipbuilding Company	80,975	45
Staten Island Shipbuilding Company	98,375	70

The contract has not as yet been awarded.

Bids Received for New York Central Scow Barges and Gasoline Hoist Barges

BIDS were received at the purchasing department of the New York Central Railroad, 466 Lexington avenue, New York city, on Thursday, October 11, for the construction of five scow barges and 10 gasoline hoist barges, separate prices being asked on the Ellis Channel system of construction and on the A.J.B. diagonal system of construction. A third price was asked in the latter case for Diesel drive.

The scows are to have a length of 100 feet and a beam of 33 feet. The gasoline hoist barges will have the same dimensions.

The bids submitted were as follows:

Bids Opened for Constructing Four Steel Barges

THE United States Engineer Office, Vicksburg, Miss., received proposals recently for the construction of four steel barges. The following bids were submitted:

Name and Address	Price	Days
Midland Barge Company Midland, Pa.	$19,200	110
St. Louis Structural Steel Company St. Louis, Mo.	20,280	120
Charles Hegewald Company New Albany, Ind.	20,600	200
Howard Shipyards & Dock Company Jeffersonville, Ind.	22,700	...
Zier Boiler & Sheet Iron Company New Albany, Ind.	24,840	150
Dravo Contracting Company Pittsburgh, Pa.	27,960	95
Alabama Drydock & Shipbuilding Company Mobile, Ala.	33,780	140

The contract has not as yet been awarded.

Texas Co. Awards Contract for S.S. Occidental Repairs

THE W. & A. Fletcher Company, Hoboken, N. J., was successful bidder for repairs to the steamship *Occidental*, bids for which were received by the Texas Company, 17 Battery place, New York city, recently. The prices subsubmitted were as follows:

Name	Price
W. & A. Fletcher Company	$28,328
Robins Drydock & Repair Company	28,320
Morse Drydock & Repair Company	30,319
Staten Island Shipbuilding Company	32,734
Theodore A. Crane's Sons Company	32,993

Several prices were submitted on a number of miscellaneous items which were not figured in the totals.

S.S. William F. Humphreys Repair Contract

A CONTRACT for repairs to the steamship *William F. Humphreys* was awarded to the New York Harbor Drydock Company, Inc., New York city, at a price of $15,891. Bids for the work were received by the Tide Water Oil Company, 11 Broadway, New York city, on Tuesday, October 9, and four other bids submitted were:

Name	Price
Morse Drydock & Repair Company	$15,482
Robins Drydock & Repair Company	16,820
Staten Island Shipbuilding Company	16,824
James Shewan & Sons, Inc.	18,634

Several prices were submitted on a number of miscellaneous items which were not figured in the totals.

Bethlehem Corporation Awarded S.S. Kentuckian Repair Contract

WITH a price of $42,960 and a time of 18 days, the San Francisco plant of the Bethlehem Shipbuilding Corporation, Ltd., San Francisco, Cal., was successful bidder for the contract covering repairs to the American-Hawaiian freighter *Kentuckian*, which was damaged in a collision recently off Point Sur with the General Petroleum tanker *Los Alamos*. Three other tenders were received for the work as follows:

Name and Address	Price	Days
General Engineering & Drydock Company, Alameda, Cal.	$44,600	26
Moore Drydock Company, Oakland, Cal.	47,400	26
Los Angeles Shipbuilding & Drydock Company, San Pedro, Cal.	54,480	29

Bids for repairs to the *Los Alamos*, which was extensively damaged about the bow, were recently opened, and the General Engineering & Drydock Company, Alameda, Cal., was low bidder with a price of $15,480 and a time of 14 days.

Contract for S.S. Seminole Repairs Awarded

THE United States Shipping Board, 45 Broadway, New York city, has awarded a contract covering repairs to the steamship *Seminole* to the New York Harbor Drydock Company, Inc., New York city, at a price of $10,747. Bids for the work were recently received, and other tenders submitted were as follows:

Name	Price
James Shewan & Sons, Inc.	$11,728
Theodore A. Crane's Sons Company	13,280
Robins Drydock & Repair Company	14,350
Morse Drydock & Repair Company	16,078
Staten Island Shipbuilding Company	16,304

S.S. Independence Hall Repair Contract Awarded

A CONTRACT for repairs to the United States Shipping Board steamship *Independence Hall* was awarded to the Theodore A. Crane's Sons Company, 25 Broadway, New York city. Bids for the work were received in the New York office of the board on October 15, with the following results:

Name	Price
Theodore A. Crane's Sons Company	$3249
W. & A. Fletcher Company	3480
Tietjen & Lang Drydock Company	3961
Morse Drydock & Repair Company	4589

Bids for S.S. Silvia Repairs Opened

THE Morse Drydock & Repair Company, Brooklyn, N. Y., submitted a price of $11,044 covering repairs to the Red Cross Line Steamship *Silvia*, bids for which were recently received by Bowring & Company, 17 Battery place, New York city. One other tender was received from the Robins Drydock & Repair Company, Brooklyn, N. Y., who submitted a price of $14,889.

Bids Received for Steel Lighter Construction

TENDERS were recently received by the Superintendent of Lighthouses, Charleston, S. C., for the construction of one 100-ton steel lighter. The new vessel is to have an overall length, molded, of 60 feet, beam of 22 feet and depth of 5 feet. Details of the bids will be available at a later date.

Detailed Prices for New York Central Scow Barges and Gasoline Hoist Barges

Name	5 Scow Barges (Ellis)	5 Scow Barges (A.J.B. Diagonal)	Time	10 Gas Hoist Barges (Ellis)	10 Gas Hoist Barges (A.J.B. Diagonal)	Time	10 Diesel Hoist Barges (Ellis)
Sun Shipbuilding	$	$33,500	185	$	$44,000	260	$45,000
Ira S. Bushey	.....	.....	...	32,000	25,575	...	.....
Todd Drydocks	42,223	35,953	240	51,165	47,047	448	52,671
New York Ship	33,300	33,400	180	42,600	42,300	210	.....
Staten Island	.....	27,980	140	31,800 (wood)	35,225	7 mo.	.....
Atlantic Ellis	26,500	23,000	120	34,400	31,000	...	.....
Brewer Drydocks	.....	23,950	120	.....	30,950	120	.....
R. Lenahan	.....	.....	...	27,140 (wood)	.....	2 mo. and 4 weeks	.....
Bethlehem Shipbuilding	.....	24,265	150	.....	32,305	270	.....
Newport News	39,000	33,600	225	47,100	41,400	330	45,400
Federal Shipbuilding	.....	31,000	200	.....	40,000	300	.....
Hiltebrandt	.....	.....	...	27,500 (wood)	.....	200	.....
Dravo Contracting Co.	27,770	22,950	135	35,330	29,700	160	.....
Crowninshield Company	46,000	44,000	7 mo.	55,000	52,000	8 mo.	.....

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Bids Received for Harbor Patrol Boat Construction

THE United States Supervisor of New York Harbor, 39 Whitehall street, New York city, received sealed bids at noon, October 24, for furnishing all labor and materials and performing all work for one 121-foot, steel-hull patrol vessel.

The new vessel will have the following general characteristics:

Length overall	121 feet 5½	inches
Length between perpendiculars	114 feet 0	inches
Length of main deck, molded	120 feet 3	inches
Breadth, molded	24 feet 0	inches
Breadth, overall	25 feet 4⅞	inches
Depth at side, molded	13 feet 3	inches
Depth at center line, molded	13 feet 9	inches
Sheer forward, molded	4 feet 9	inches
Sheer aft, molded	3 feet 0	inches
Camber in 24 feet, molded	0 feet 6	inches

There is to be installed one sectional watertube, cross-drum, marine-type boiler with a heating surface of not less than 2530 square feet, designed for a gage pressure of 225 pounds per square inch and fitted with a superheater capable of producing 50 degrees superheat. The boiler is to be fitted for burning fuel oil.

One triple-expansion, propelling engine of the vertical inverted, surface-condensing type is also to be installed, having cylinders 13 inches, 21½ inches and 36 inches in diameter by 24 inches stroke.

Specifications for Twenty Fuel Barges Soon to be Issued

SPECIFICATIONS for the construction of twenty 110-foot by 24-foot creosoted wooden fuel barges for the United States Engineer Office, Rock Island, Ill., are to be issued in about three weeks time. Tenders for the work were originally received on August 29, but these were rejected. Further details will be available at a later date.

Lloyd's Quarterly Shipbuilding Returns

THE volume of world construction of merchant vessels is now at a lower point than in any period since the ending of 1926, according to a report just issued by Lloyd's Register of Shipping, covering returns from all countries for the quarter ended September 30, 1928. The present total of 2,521,342 gross tons is nearly 600,000 tons less than that at the beginning of this year.

The shrinkage in shipbuilding is chiefly due to the situation in Great Britain and Ireland, where about 110,000 gross tons less are being built now than three months ago. During the same period, the decline for all other countries combined was only about 25,000 tons. As a result, Great Britain and Ireland, which, comparatively recently, were constructing more shipping than all other maritime nations together, now have only about 43 percent of the total.

While the United States made a gain during the past quarter of 9000 tons, its proportion of the world total is only 2.7 percent. This, however, compares with only 2.0 percent in the quarter ended June 30, 1928. During the quarter ended September 30, increases in the volume of production were also shown by Germany, Holland, France, and Sweden; while decreases were recorded for Great Britain and Ireland, Italy, Russia, Japan and Denmark.

Tanker Construction

A decline of over 120,000 gross tons in the construction of tank steamers and motor tankers is shown in the returns, and this follows a drop of nearly 100,000 tons in the quarter ending with June. There are now over 320,000 tons less of this type of ship being constructed than at the beginning of this year. The reduction in Great Britain and Ireland during the quarter just ended was 36,000 tons, compared with 85,000 tons for the other countries together.

Motorship Construction

While there was a decrease of about 80,000 gross tons in the construction of motorships during the quarter just ended, this represents a decline of less than six percent, as compared with the total for the previous quarter. An increase in the volume of construction was shown during the past quarter by Holland, Sweden and France, while Great Britain and Ireland, Germany and Italy decreased in construction.

The world total of motor vessels under construction at the end of the last quarter was 1,419,602 gross tons, as against 1,500,544 at the close of the previous quarter. The building of vessels of this type now aggregates over 300,000 tons more than the total of all other types of ships combined; and motorships now represent 56.3 percent of all construction, as contrasted with 51.6 per cent at this time last year. In the quarter ending June 30, the proportion was 56.4 percent, so the present decline is a slight one.

Marine Section of the National Safety Council Elects Officers

AT the annual meeting of the National Safety Council, Marine Section held at the Hotel Waldorf-Astoria, New York city, October 1 to 5, the following officers were elected for the coming year:

Chairman—A. R. Bush, The Barber Asphalt Company, Mauerer, N. J.
Vice-Chairman—(In charge of Membership and Publicity Committees) Arthur M. Tode, The Texas Company, New York city.
Vice-Chairman—(In charge of Information and Service Committees) Captain R. C. Brennan, Oceanic Terminals, Portland, Oregon.
Vice-Chairman—P. P. Foisie, Waterfront Employers Association, Seattle, Washington.
Secretary and News-Letter Editor—Capt. W. P. Kain, Shipowners' Claims Bureau, Inc., New York city.
Chairman Program Committee—John S. Hunter, The Atlantic Refining Company, Philadelphia, Pa.
Chairman Research and Statistics Committee—Captain Irving L. Evans, Munson Steamship Line, New York city.
Chairman Stevedoring Committee—Frank A. Fritz, T. Hogan & Sons, Inc., New York city.
Chairman Engineering Committee—Capt. G. Bartlett, Cosmopolitan Shipping Company, Hoboken, N. J.

Executive Committee

E. F. Daly, Morse Drydock & Repair Company, Brooklyn, N. Y.
R. F. Edwards, The Prudential Insurance Company, Newark, N. J.
Capt. Reginald Fay, The New York Central R. R. Company, New York city.
Chas. H. Flathers, Eastern Steamship Lines, Inc., Boston, Mass.
W. A. Kiggins, Jr., A. H. Bull and Company, Inc., New York city.
Ellis Knowles, C. D. Mallory & Company, Inc., New York city.
Capt. C. A. McAllister, American Bureau of Shipping, New York city.
D. J. Murphy, Murphy Cook and Company, Philadelphia, Pa.
Capt. C. H. Potter, Potter Transportation Company, New York city.
W. E. Stewardson, Colombian Steamship Company, Inc., New York city.
C. Story, Jr., Cities Service Transportation Co., New York city.
Fern Wood, Williams Steamship Company, Inc., New York city.
J. Wright, Export Steamship Corporation, New York city.
W. E. Welch, Travelers Insurance Co., New York city.

Supply Trade

Winton Engine Company Reorganizes

THE Winton Engine Company, Cleveland, O., one of the oldest builders of American Diesel engines, has recently effected a complete reorganization, incorporating the new concern under the laws of the State of Ohio. The new company now controls all of the outstanding capital stock of the former corporation of the same name.

The principal reasons for the reorganization were to permit the retirement of some of the former officers, who wished

Alexander Winton

to do so, from active participation in the conduct of the company's affairs, and to augment the company's facilities to meet

Geo. W. Codrington

the demands of an increasing volume of business.

Alexander Winton, founder of the company, and for many years its president, now becomes chairman of the board of directors. Mr. Winton's career in the Diesel industry is well known. As a pioneer, inventor and mechanical engineer with many notable achievements to his credit, he occupies a foremost place in the list of those who have contributed to the development of the high-speed Diesel-type engine in this country.

George W. Codrington, former vice-president, is president of the new corporation. He will be in direct charge of

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the many activities pertaining to the designing, building and marketing of the company's products. Mr. Codrington's elevation to the position of chief executive is the logical result of his successful conduct of the company's business in the past ten years, during which time Winton products have been brought to their present outstanding position.

Another man who has aided in the success of the company and who now becomes vice-president is Arthur G. Griese. Mr. Griese started with the company upon his return from France immediately after the World War. Since that time he has actively represented the Winton Engine Company on the eastern seaboard.

The directors of the new company will consist of Alexander Winton, George W. Codrington, A. G. Griese and the following nationally and internationally known financial men: Frank H. Shaw, vice-president of John Burnham & Company, Chicago, Ill.; Ralph Hubbard of John Burnham & Company; I. F. Freiberger, vice-president of the Cleveland Trust Company, Cleveland, Ohio; Howard Whitehouse, Continental National Bank, Chicago, Ill., and Sheldon Noble of W. Noble Company of Detroit, Mich. The officers of the company, in addition to Messrs. Winton, Codrington and Griese, consist of F. H. Shaw, vice-president; W. S. McKinstry, secretary and treasurer, and D. A. Lake as assistant treasurer.

The operating and sales personnel of the company remains unchanged. As in the past the company will continue to build marine and industrial engines, both Diesel and gasoline types, and the officers and staff will adhere strictly to the policy of maintaining the high quality of Winton products.

American Shipbuilding Company's Annual Report

THE twenty-ninth annual report of the American Shipbuilding Company, Cleveland, Ohio, for the fiscal year ended June 30, 1928, indicates that the business of the company for the past year has been much smaller in volume than for the preceding year, due to the small amount of new ship construction. New ship work was nearly $4,000,000 less, though repair business and miscellaneous contracts were only slightly below those for 1927.

The surplus, June 30, 1928, after payment of dividends on preferred stock to the amount of $47,636.75 and $1,172,492.00 on common stock stood at $5,654,179.81 as compared with $6,407,722.97 for June 30, 1927. The net profit for the year ended June 30, 1928, was $510,695.44.

General Electric Company Quarterly Report

ORDERS received by the General Electric Company, Schenectady, N. Y., for the three-month period ending September 30, amounted to $90,328,666, compared with $77,420,263 for the corresponding quarter of 1927—an increase of 17 percent. For the nine months ended September 30, orders received amounted to $260,686,463, compared with $233,076,091, for the first nine months of last year—an increase of 12 percent.

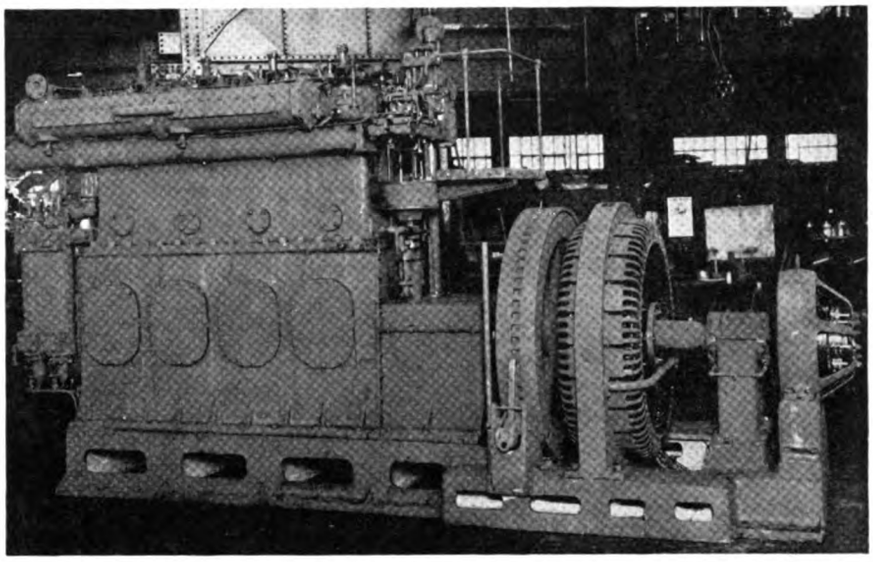
Work in the Busch-Sulzer Diesel Engine Plant

THE Busch-Sulzer Bros.-Diesel Engine Company, St. Louis, Mo., has recently completed a 225 horsepower Diesel-engine generating set for installation on a new concrete mattress barge for river revetment work, which is to be used by the Mississippi River Commission, Fourth District of New Orleans, La. This marks the first application of the Diesel engine to flood-control work under the program undertaken by the Mississippi River Commission.

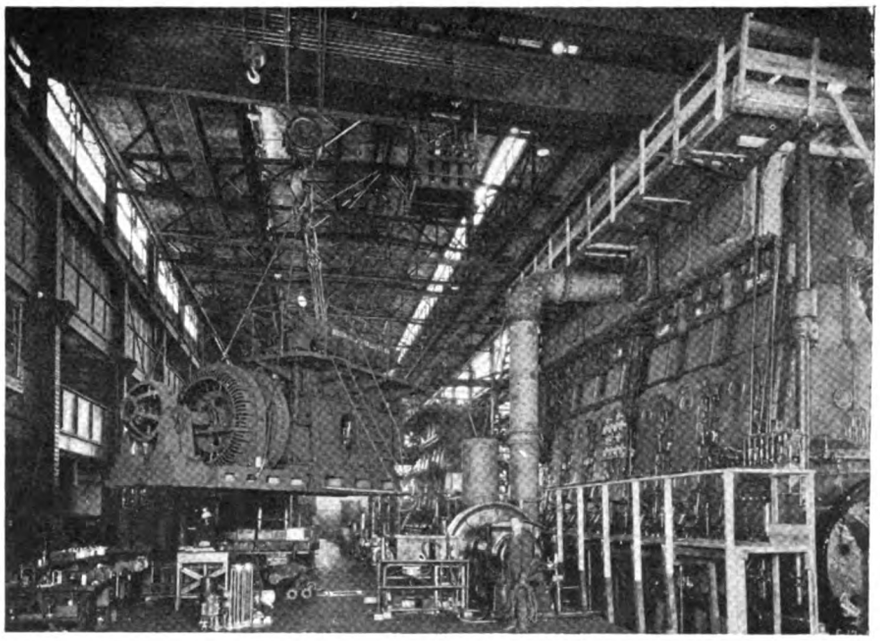
The unit consists of a 4-cylinder engine driving a 3-phase 60-cycle, 480-volt alternating-current generator supplied by the General Electric Company, Schenectady, N. Y. The engine, generator and a direct-connected exciter are all mounted on a common base. Shipment of the unit ready for installation on the barge was made from the plant 43 days after the order was placed.

The largest order now underway in the Busch-Sulzer plant is that for two 3950 brake-horsepower reversing marine engines for the United States Shipping Board. These engines, which are shown in one of the illustrations, are of the 2-cycle, single-acting, 6-cylinder type having a cylinder bore of 30 inches and a stroke of 52 inches.

The shop tests of the first of the two engines were commenced on October 1. The fuel consumption for this unit, after allowing for power to drive a turbo blower supplying scavenging air, is about 0.40 pound per horsepower hour. It is estimated that this engine with sea-auxiliary requirements of about 100 horsepower will have a fuel consumption for all purposes of approximately 0.43 pound per shaft horsepower per hour.



Busch-Sulzer 225-horsepower Diesel generator set for installation on Mississippi river barge



Small generating set and two 3950-brake-horsepower Shipping Board engines in the Busch-Sulzer plant

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A third large engine, of 3750 brake horsepower, for stationary use, not shown in the illustration, is being built for the Federal Light & Traction Company for installation at Tucson, Ariz.

New York Shipbuilding Company Reverts to Old Name

THE American Brown Boveri Electric Corporation, Camden, N. J., has announced the separation of its electric and shipbuilding activities by organizing a subsidiary under the name of the New York Shipbuilders Company, leasing to the new company all of the real estate and plant embraced in the active shipbuilding facilities at Camden. The management includes: W. M. Flook, chairman of the board; C. L. Bardo, president; J. E. Slater, vice-president and treasurer; E. I. Cornbrooks, vice-president and general manager; M. H. Torbet, assistant general manager; E. H. Rigg, naval architect; Norman R. Parker, comptroller, and A. G. Connell, secretary.

Business and Personal

A. E. Chase was recently placed in charge of the new sales office of the **Columbian Rope Company** at 1083 Drexel building, Philadelphia, Pa.

Ralph Miller, formerly assistant chief engineer of the oil engine department of the **Ingersoll-Rand Company,** Phillipsburg, N. J., has been appointed chief engineer.

Martin L. Katzenstein, 117 Liberty street, New York city, was recently appointed exclusive Eastern marine representative for the **Warren Steam Pump Company, Inc.,** of Warren, Mass.

The **Falk Corporation,** Milwaukee, Wis., announces the appointment of **B. W. Rogers,** 225 Central Savings and Trust building, Akron, Ohio, as its representative for Akron and surrounding territory.

Walter Castanedo, Inc., Maritime building, New Orleans, La., has been appointed agent for the **Peabody Engineering Corporation,** New York city, in the states of Louisiana, and Mississippi.

Captain J. E. Dorry, Spear and Mission streets, San Francisco, Cal., was recently appointed west coast distributor for **Nils F. Nord,** New York city, American agents for the **Tyfon,** a new type of sound signalling apparatus.

J. E. Craig, vice-president of the **Clyde and Mallory Lines,** New York city, has announced the following changes in personnel: **H. G. White,** general agent at Jacksonville, has retired; **W. J. Martin,** having resigned as agent at Jacksonville, the position was abolished; **G. W. Bartlett,** general agent of the Mallory Line at Tampa, was appointed general agent of the Clyde and Mallory Lines at Jacksonville and Tampa, and **R. L. Gillett** was appointed agent of the Mallory Line at Tampa.

Trade Publications

Water Gages.—Stove's patent gun metal water gages are outlined in a leaflet issued by Nunan & Stove, Ltd., Glasgow, Scotland.

Celite.—The Celite Products Company, Los Angeles, Cal., has issued a bulletin entitled "Celite Cross Sections" in which the uses of Filter-Cel, Super-Cel, Sil-O-Cel and Celite are described.

Copper and Brass.—The maritime uses of copper and brass are set forth in the October 1 bulletin of the Copper & Brass Research Association, New York city. The leading article is entitled "Copper protects the Fleets that Guard America."

Liquid Level Gages.—Catalogue No. 1800 has been distributed by the Bristol Company, Waterbury, Conn., defining the application of recording liquid level gages. These gages may be used in determining the depth of liquid in tanks, boilers or similar application.

Panama Canal.—A description of the port facilities, harbor conditions, port customs and regulations of the Panama Canal and its ports is given in a booklet published by the War Department, Corps of Engineers, United States Army, and the United States Shipping Board and designated as "Port Series No. 22."

Diesel Engines.—Fairbanks, Morse & Company, Chicago, Ill., has issued a house organ entitled "The F-M News" which describes various ships in which Fairbanks-Morse Diesel engines have been employed.

Motors.—The General Electric Company, Schenectady, N. Y., has issued catalogue pages covering wound-rotor induction motors, 900 series, and high-torque double squirrel-cage motors. Another page is devoted to the type CR2927 pressure and vacuum switches.

Flexible Couplings.—The Falk Corporation, Milwaukee, Wis., has published a new bulletin on Falk Flexible couplings. This bulletin contains information and data relative to the types of couplings developed for various services. The operating principle of the coupling is described and a new list of service factors given.

Winton News.—The October issue of "Winton News" published by the Winton Engine Company, Cleveland, Ohio, contains a description of the new cruising houseboat, *Day Dream,* built by the Mathis Yacht Building Company, Camden, N. J., for Senator W. H. Reynolds of New York city. Her length is 125 feet; beam, 22 feet; draft 4 feet 6 inches. She is propelled at a speed of 12 miles per hour by two six-cylinder new-type Winton Diesel engines.

Marine Societies

America

American Marine Association, 30 Church St., New York. President—Col. E. A. Simmons.

American Marine Standards Committee. Chairman, Colonel E. A. Simmons. Secretary, A.V. Bouillon, Division of Simplified Practice, Department of Commerce, Washington, D. C.

American Society of Marine Designers. Secretary—B. G. Barnes, 202 Kendrick Ave. Quincy, Mass.

American Society of Marine Engineers. 605 Market St., San Francisco, Calif. President—James Bullock. Secretary—W. H. Thille.

American Society of Naval Engineers. Navy Department, Washington, D. C. Secretary and Treasurer—Captain O. L. Cox, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

American Steamship Owners' Association, 11 Broadway, New York. President—H. B. Walker.

Jersey Marine Club, 4th and River Streets, Hoboken, N. J. Secretary—Fred L. Broad.

Lake Carriers' Association. President—J. S. Ashley. Secretary—George A. Marr, Rockefeller Building, Cleveland, O.

National Association of Engine and Boat Manufacturers. 420 Lexington Avenue, New York City. Secretary—Ira Hand.

National Association of Masters, Mates and Pilots. National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

National Council of American Shipbuilders, Inc., 50 Broadway, New York. President—Homer L. Ferguson. Secretary-Treasurer—Henry C. Hunter.

National Marine Engineers' Beneficial Association. Headquarters 311-315 Machinists Building, Washington, D. C. President—Wm. F. Yates. Secretary—Albert L. Jones.

Neptune Association, 21 Pearl St., New York City. Secretary-Treasurer—Captain John F. Milliken.

New York and New Jersey Dry Dock Association. 111 Broadway, New York. President—Jonathan Moore.

Ocean Association of Marine Engineers. 15 Whitehall St., New York. Secretary—Bert L. Todd.

Port of New York Authority, 75 West Street, New York. Chairman—George S. Silzer. Secretary—Wilson J. Vance.

Society of Naval Architects and Marine Engineers, 29 West 39th Street, New York. Secretary and Treasurer—Daniel H. Cox.

The Maritime Association of the Port of New York, 78 Broad St., New York City. President—John Dowd. Secretary—John F. Manning.

The New York Tow Boat Exchange, 11 Moore St., New York. Manager—Langdon W. Smith.

The Propeller Club of the Port of New York. President—E. M. Roberts, New York. Secretary—W. Z. Gardner, 136 Liberty Street, New York.

United States Naval Institute. Naval Academy, Annapolis, Md. Secretary and Treasurer—Captain H. A. Baldridge, U. S. N.

United States Ship Operators' Association, 149 Broadway, New York. President—Winchester Noyes.

Canada

Grand Council N. A. of M. E. of Canada. Grand Secretary-treasurer—W. A. MacDonald, 62 Albert St., Halifax, N. S.

Great Britain

Institute of Marine Engineers Incorporated, 85-88 The Minories, London E.1.

Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow.

Institution of Naval Architects, 2 Adam Street, Adelphi Terrace, London, W. C.

North East Coast Institution of Engineers and Shipbuilders. Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

France

Association Technique Maritime et Aëronautique. Secrétariat Général—7, rue de Madrid, Paris (8e).

Italy

Collegio Degli Ingegneri Naval e Meccanici In Italia.

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